

PACIFIC SEABIRDS



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PACIFIC SEABIRD GROUP

Dedicated to the Study and Conservation of Pacific Seabirds and Their Environment

The Pacific Seabird Group (PSG) was formed in 1972 due to the need for better communication among Pacific seabird researchers. PSG provides a forum for the research activities of its members, promotes the conservation of seabirds, and informs members and the public of issues relating to Pacific Ocean seabirds and their environment. PSG holds annual meetings at which scientific papers and symposia are presented. The group's publications include *Pacific Seabirds* (formerly the *PSG Bulletin*), *Marine Ornithology* (published jointly with the African Seabird Group), symposium volumes, and technical reports. Conservation concerns include seabird/fisheries interactions, monitoring of seabird populations, seabird restoration following oil spills, establishment of seabird sanctuaries, and endangered species. Policy statements are issued on conservation issues of critical importance. PSG members include scientists, conservation professionals, and members of the public from both sides of the Pacific Ocean. It is hoped that seabird enthusiasts in other parts of the world also will join and participate in PSG. PSG is a member of the U.S. Section of the International Council for Bird Preservation, the International Union for Conservation of Nature (IUCN), and the American Bird Conservancy. Annual dues for membership are \$25 (individual and family); \$15 (student, undergraduate and graduate); and \$750 (Life Membership, payable in five \$150 installments). Dues are payable to the Treasurer; see Membership/Order Form next to inside back cover for details and application.

Pacific Seabirds

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REPORT

SANTA BARBARA ISLAND: NOT FAR FROM JAPAN, FOR A RESEARCHER AND A SHORT-TAILED ALBATROSS

Koji Ono

[Editor's note: A field trip to Santa Barbara Island, California, was among the one-day excursions that were arranged for attendees at PSG's Annual Meeting in February 2002. Other reports on the meeting follow.]

The first time I heard of Santa Barbara Island was ten years ago. As a first-year master's degree student, I was doing a literature search on alcids in preparation for a study of the breeding biology of the Japanese Murrelet (*Synthliboramphus wumizusume*). Among the papers I acquired was one by Murray et al. entitled "Breeding biology of the Xantus' Murrelet (*S. hypoleucus*)" (Condor 85:12, 1983).

English is the first language for the majority of PSG members, a status that allows them to read and write the language effortlessly. For me, however, being Japanese, reading a scientific paper in English usually involves a full day's work with dictionary in hand. But I clearly remember reading the Murray et al. paper with particular pleasure, while in my research lab sipping coffee. Seeing photographs of Xantus's Murrelet chicks, so like newly hatched Japanese Murrelets, and the species' nesting environment with its rocky terrain, I thought just how very much I would like to visit the island. But I never thought I would ever really be able to go.

At the 2001 PSG Annual Meeting in Kaua'i, Harry Carter told me that the venue for the following year's meeting would be Santa Barbara, California, and he encouraged me to attend. Although the meeting would be held out-

side of the Xantus's Murrelet breeding season, he told me I'd be able to see birds on the water and examine the species' nesting environment. As many people are aware, Xantus's Murrelet chicks are precocial, like those of its cousin, the Japanese Murrelet, and its breeding biology is also similar to that of the Ancient and Craveri's Murrelets (*S. antiquus*, *S. craveri*).

On 19 February 2002, still suffering the effects of jet lag, my wife Mihoko and I boarded the Channel Islands National Park vessel *Ocean Ranger II*. As we made our way out of port, we encountered a lone common dolphin (*Delphinus delphis*). Less than 30 minutes later, a whole pod of its friends had gathered, and for a brief time we were in the company of these graceful creatures as they cruised and leapt at our bow.

The first stop on our tour was Anacapa Island. We dropped off some passengers, then circled around to another part of the island where a few researchers in a Zodiac were let off. We had set anchor offshore, rolling with the swells. I was cold and felt a little queasy, so I went to make myself more comfortable in the cabin at the bow of the ship.

The leg of our trip from Anacapa Island to Santa Barbara Island seemed long. I looked through the cabin window, keeping my eyes on the water. Not far from Santa Barbara Island I spotted a Xantus's Murrelet. The smallish bird reminded me of the Japanese Murrelet in the way that, after spotting our ship, it quickly slipped under the water with much fluster.

We arrived at Santa Barbara at about 1 PM., and a group of sea lions

(*Zalophus californianus*) saw us safely to the island's shore. Santa Barbara was much larger than I had imagined. After climbing some steep stairs, we headed for the brown pelican (*Pelecanus occidentalis*) colony, making our way on foot through a strange landscape of desiccated soil and giant *Coreopsis* plants. Paige Martin of Channel Islands National Park described how the recent drought had reduced mouse numbers on the island, and she told us about mouse and owl dynamics and their influence on Xantus's Murrelets.

When we reached the top of the coastal cliffs, we saw many pelicans and sea lions on the rocks below. The birds were incubating, and we noticed that most nests contained two eggs. Paige commented that three eggs were more typical. Although I would have liked to spend more time there, we had to return to the ship.

In my student days, the first place I conducted Japanese Murrelet research was in the Izu Islands south of Tokyo, on the extremely rocky Kojine Reef. Kojine is much smaller than Santa Barbara Island: only 150 by 50 meters, with the top of the island just 40 meters above water. Japanese Murrelets nest in openings within piles of rocks and crevices in steep rocky slopes. I later moved my research to Biro Island in Miyazaki Prefecture, off the east coast of Kyushu. That island is 400 meters square and 85 meters high at its top, and is crowned by broad-leaved evergreen forest. Streaked Shearwaters (*Calonectris leucomelas*) have laid claim to most nesting sites on the forest floor, so the Japanese Murrelets nest beneath rocks and in crevices in the

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REPORT

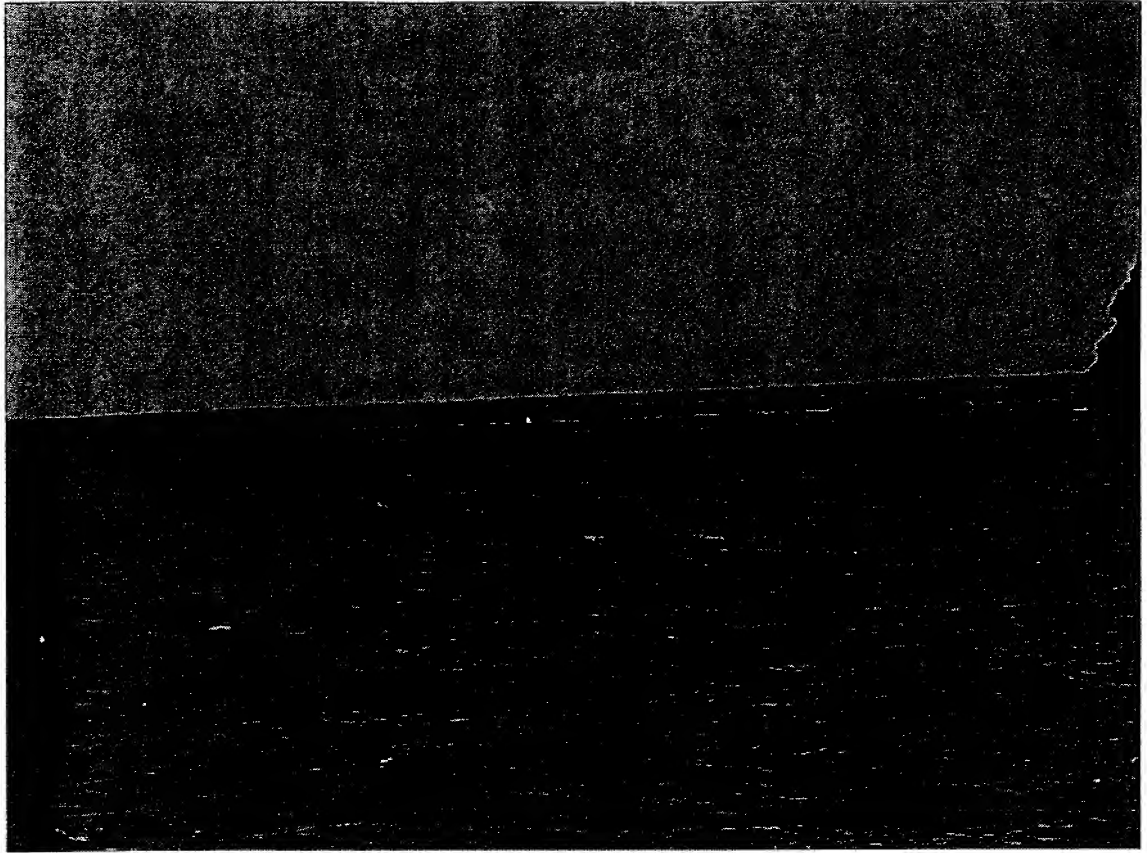


FIGURE 1. Juvenile Short-tailed Albatross in the Santa Barbara Channel, California, 19 February 2002. By Koji Ono.

steep rocky slopes that make up the island's periphery. As it was not yet the breeding season during my visit to Santa Barbara Island, I wasn't able to see actual nesting Xantus's Murrelets, but being there I couldn't help but be reminded of the many similarities and relatively few differences among *Synthliboramphus* species. I kept thinking I'd like to return someday.

Sometime after 3:10 PM., the ship moved away from the island. A little while later someone shouted "Short-tail!" I saw a large black bird with a pink bill, flying in front of the ship. It was 3:19 PM, and we were probably no more than a mile from Santa Barbara Island. I've only seen a Short-tailed Albatross (*Phoebastria albatrus*) once in Japan, but my wife has observed two individuals on separate occasions. We were certain this was another, and I was able to take three digital photographs of the bird as evidence (Figure 1).

Our boat arrived at Ventura Harbor at 6 PM. The 2002 annual meeting of the Pacific Seabird Group had, for us, started very auspiciously.

At the conference, we heard that our Short-tail sighting was the first one documented in the Channel Islands since the 1800s, so the digital photos I had taken of the bird were the focus of much attention among conference attendees.

After returning to Japan, I sent my photos to Hiroshi Hasegawa, who had just returned from a survey in the Senkaku Islands. Dr. Hasegawa is well known for his work on the Short-tailed Albatross and was faculty advisor for

my past research on the Japanese Murrelet at Toho University. This was his reply: "Judging from the uniform blackness of the body, I'd say the bird was one or two years old. Most likely it was born last year. In the third year, about half return to their natal area. In the fourth year, they arrive at the nesting grounds from which they fledged. This opportunity to see a Short-tail in the Channel Islands was probably due in large part to the increase in the breeding populations at Torishima and the Senkaku Islands. The fact that young birds are being found in southern areas, well distant from their breeding grounds, backs this up. (H. Hasegawa, 8 March 2002, pers. comm. by telephone.)

At one time, the Short-tailed Albatross was being killed in huge numbers at its breeding grounds on Torishima, and it subsequently was declared extinct. But thanks to the work of Dr. Hasegawa and his collaborators, with the cooperation of the Japan Ministry of the Environment (JME) and the U.S. Fish and Wildlife Service (USFWS), the Torishima population has been recovering steadily. Dr. Hasegawa was recognized for his long-term efforts to save the Short-tailed Albatross when he was presented with a Special Achievement Award by PSG in February 2001.

But it needs to be pointed out that there is a large number of other seabird species in Japan whose populations also are threatened, a fact that is not very widely known. Indeed 22 of 38 seabirds breeding in Japan (60%) are currently included in the Red Data List

published by the JME. There also are species whose present status is unknown. For example, Matsudaira's Storm-Petrel (*Oceanodroma matsudairae*) is believed to breed in the Ogasawara Islands, but no survey has been conducted on this population in 80 years, and its current status is unclear. A similar story can be told about other species. We feel it's time to seriously consider taking a more comprehensive approach to seabird conservation that extends beyond US-Japan joint efforts. A positive note in this regard is the Japan-US seabird symposium that will be held in Haboro, Hokkaido, in October 2002. This could not have happened without the hard work of Kent Wohl (USFWS), Naoko Nakajima (JME), and John Fries, Yutaka Watanuki, and other active members of the Japan Seabird Group. This symposium is being designed to promote seabird conservation and research in general, and we hope to have the participation and cooperation of large numbers of people.

I'd like to thank Harry Carter, Paige Martin, and Channel Islands National Park for arranging my field trip to the Channel Islands. I'd also like to express my deep appreciation to Pauline Nol, Roy Lowe, Keith Roney, Roger Helm, and others who were companions on the field trip to Santa Barbara Island and who shared their thoughts at the Santa Barbara conference. John Fries translated this article into Japanese. Were it not for John's efforts, Japan and the United States would certainly feel far more distant from each other than they currently do.

LIFETIME ACHIEVEMENT AWARD

The Pacific Seabird Group occasionally honors outstanding contributors to seabird science and conservation with Lifetime Achievement or Special Achievement awards. PSG presented its Lifetime Achievement Award to Philip and Myrtle Ashmole at the 29th annual meeting on 23 February 2002.



PHILIP AND MYRTLE ASHMOLE

Lisa T. Ballance

At the Pacific Seabird Group's Annual Meeting in February 2002, it was our distinct honor to present PSG's Lifetime Achievement Award to a pair of scientists whose names will be familiar to every member: Philip and Myrtle Ashmole.

The Pacific Seabird Group periodically presents awards to outstanding individuals in the field of marine ornithology. One of these, instituted in 1993, is the Lifetime Achievement Award. This award recognizes a seabird researcher, educator, or conservationist who has made significant, long-

term contributions to seabird science, conservation and education in the Pacific Ocean or the world. There is no mandate to present this award at every meeting, and in fact we have not done so. Rather the award is presented irregularly when a nomination for an outstanding marine ornithologist is received and approved by the Executive Council. Past recipients of this award are James Bartonek, Thomas Howell, Miklos Udvardy, William Bourne, Karl Kenyon, John Warham, Charles Guiguet, James King, and Richard Brown.

In 1957, Philip Ashmole began his study of tropical seabirds as a member of the British Ornithologists Union Centenary Expedition to Ascension Island in the Atlantic. From 1957 to

1959, he conducted his doctoral research there, and in 1961 he obtained his D.Phil. from Oxford University for his dissertation, *The Biology of Certain Terns*. He was not focused exclusively on seabirds, for also during this time, he and Myrtle were married. The Ashmoles remained at Oxford for a few years longer, Philip as a research assistant of the Edward Grey Institute of Field Ornithology. In 1963 they discovered the Pacific Ocean and their research focus moved there. In 1964 Philip became an Assistant Professor of Biology at Yale University. He would stay there for almost another ten years, becoming Associate Professor in 1969.

The Ashmoles' studies of seabirds on Christmas Island, and the influence

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of the Ascension Island research on this work, are legendary to seabird biologists. By the early 1970s, their collection of scientific papers had made significant contributions in seabird biology and were having far-reaching consequences for the field. A few examples will make this point:

- 1963: Philip Ashmole, "The regulation of numbers of tropical oceanic birds": In this classic paper, Philip proposed that seabird populations are regulated by food supply during the breeding season. "Ashmole's Halo" is the name by which this idea is now known, together with its corollary that seabirds, which are constrained to be central-place foragers, deplete the prey around their colonies. The "halo" has remained a paradigm that continues to be debated to this day.
- 1967: Myrtle and Philip Ashmole, "The use of food samples from sea birds in the study of seasonal variation in the surface fauna of tropical oceanic areas": This was one of the first papers to use seabirds as indicators of the oceanic environment, an idea that would catch the attention of many seabird and fisheries biologists and managers much later.
- 1967: Philip and Myrtle Ashmole, "Comparative feeding ecology of sea birds of a tropical oceanic island": This was one of the earliest colony-wide studies that addressed comparative ecology for an entire community. It was also one of the earliest attempts to address both parts of a seabird's life, on land and at sea, and to integrate the two into a single, more complete story.
- 1968: Philip Ashmole, "Body size, prey size, and ecological segregation in five sympatric tropical terns": This was among the earliest papers that attempted to place seabirds in the broader ecological context, as it was being developed amongst terrestrial biologists, in order to explain how similar species can co-exist.

- 1971: Philip Ashmole, "Sea bird ecology and the marine environment": This now-classic paper was one of the first that attempted to place seabirds in a broader context relative to the oceanic environment. It contains a famous Figure 1 entitled "Sea bird feeding methods." The figure has been reproduced in books, papers, and countless lecture handouts. Even as I was leaving to attend the PSG meeting, I had my teaching assistant make copies of this paper for my graduate class on marine tetrapods.

These few examples are typical of the Ashmoles' seabird work. Their research was meticulously conducted, their data thoroughly analyzed, their results widely disseminated, and their work raised broad implications. These strengths are well-illustrated by a story a colleague of mine, Chris Thompson, told about the Ashmoles' contribution to our understanding of molt. Here are some excerpts from Chris's letter:

In the context of bird studies, when most people think about the Ashmoles, they think of contributions to our understanding of breeding and foraging ecology of seabirds. One of their lesser appreciated, but no less important, contributions was to our understanding of molt. As a graduate student at Oxford, Philip studied the breeding biology of Black and Brown Noddies, and Sooty Terns on Ascension Island. His studies included molt and he developed a numerical scoring system that was subsequently to form the basis for the Molt Enquiry developed for the British Trust for Ornithology and still used to this day.

Unlike many large birds, including many seabirds, that do not replace all of their primaries in a single molt between the end of breeding one year and the beginning of breeding the next, Philip found that Brown and Black Noddies and Sooty Terns all undergo a complete primary molt between consecutive breeding seasons. But, these three species have intriguing differences. Brown Noddies breed on a regular 12-month schedule, and birds often molt flight feathers for the entire duration of their breeding. Black Noddies breed every eleven months, and

typically only molt during the very beginning and very end of breeding—thus minimizing the overlap between the two. Sooty Terns breed on an even shorter cycle, every 9-10 months, and have even less molt-breeding overlap than the two noddies. So, why these differences? Because Sooty Terns are larger than both noddies, yet have shorter molt durations and breeding cycles, body size could not be the major determinant. Philip reasoned that food supply for a given species is relatively constant year-round in tropical environments, and concluded that the duration of the breeding cycle of tropical species is determined by two factors: (1) the time necessary to breed (including time for social facilitation at the beginning of the season) and (2) the time necessary for flight feather molt. He thus incorporated molt into life history strategies, and thus, an evolutionary context, for seabirds.

In subsequent studies of museum skins of Sooty Terns from other populations that breed on 6-month breeding schedules, Philip noted marked differences in their molting patterns, and suggested that selection may have favored unsuccessful breeders in one season to undergo only a partial molt, rather than a complete a molt, in order to be able to attempt to breed at the beginning of the next season 6 months later.

The Ashmoles also addressed molt in White and Black-naped terns. They documented a molt strategy unique to these two species and further recognized that both species are the only terns without melanin in their primaries. They suggested that the resulting translucent wings may be advantageous in reducing their conspicuousness to prey, but at the cost of a higher rate of feather abrasion. This became their proposed selection factor to explain the unique multi-wave molt strategy for these species, whereby the first primaries replaced during molt will not become excessively worn before they are replaced in the next molt cycle.

Prior to these works, most publications on molt were long, boring, descriptive accounts of sequence and timing, with no attempt to explain adaptive significance. Most ornithologists assumed that characteristics of molt were primarily driven by constraints imposed by demands of the

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breeding season and migration. In contrast, the Ashmoles' work showed that the reverse may also be true: aspects of molt may strongly influence aspects of the breeding cycle—in other words, molt can be a strong driving force in the evolution of life-history strategies.

These excerpts from Chris's letter illustrate well the reason why the Ashmoles' contribution to seabird biology was so great, and why their papers continue to be cited so long after they were published: because they placed seabird biology in an evolutionary context. By so doing, they spoke to scientists in other disciplines, and they challenged us in this discipline to test their ideas.

In 1972, Philip took a position at the University of Edinburgh, where the Ashmoles have remained ever since. With this geographic move came a shift in their research interests. Most of us know that their seabird publications ceased to appear by the mid-1970s. Many may not be aware that they have continued jointly to conduct research, publish, and influence other fields right up to this day—spider biology, cave entomology, and restoration ecology among them. What is more, in the year 2000, their substantial biological work on Atlantic islands culminated with their jointly published book, *St. Helena and Ascension Island: A Natural History*.

Given the depth of their insight and the impact of their papers on seabird ecology, one may wonder: why did the Ashmoles move away from seabirds? When I was pondering this with a colleague of mine some time ago, he speculated, "Perhaps they were too big for seabird biology—it may be that their interests and ideas could not be contained within a single discipline." I'd like to ask them this same question. However, whatever the reason, their attention to marine ornithology has left us with far-reaching ideas and important paradigms. Perhaps the strongest testament to their impact on our field is the fact that some thirty

years after their publication, most tropical and many high-latitude seabird papers continue to contain an Ashmole reference or two in their Literature Cited sections. Our field has been enriched by their participation, and it has been changed forever.

One final note seems appropriate. Not only is this the first time we are awarding the Pacific Seabird Group's Lifetime Achievement Award to a pair of scientists, it is the first time we are awarding it to a woman. Other women will receive the award; but it is appropriate that the first is Myrtle Ashmole, who perhaps is the first woman to make major contributions to the study of seabirds.

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Lisa Ballance and Mark Rauzon deciphering notes for banquet speeches



Philip and Myrtle Ashmole in the field—California Condor field trip, 24 February

CONSERVATION NEWS

Craig Harrison

PSG PETITIONS TO LIST XANTUS'S MURRELET UNDER ENDANGERED SPECIES ACT

At its annual meeting in Santa Barbara during February, PSG's Executive Council approved submitting a petition to the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game to list the Xantus's Murrelet (*Synthliboramphus hypoleucus*) as a threatened species. The petition was prepared by PSG members Gerry McChesney and Scott Newman on contract to PSG, and was formally submitted to the agencies in April. It is unclear how quickly USFWS will act on the petition, but in March 2002 the 9th Circuit Court of Appeals in San Francisco ruled that the federal government must determine whether a species is endangered or threatened within one year of receiving a petition for listing (*United States v. Biodiversity Legal Foundation*). Moreover, the Endangered Species Act requires the USFWS to make an initial finding whether to proceed with a species petition within 90 days, to the "maximum extent practicable." USFWS has often taken several years to make such determinations, and counters that it is hindered by budgetary and staffing shortages.

JUDGE RULES THAT NAVY BOMBING SEABIRD COLONY VIOLATES MIGRATORY BIRD TREATY ACT; CONGRESSIONAL BACKLASH IMMINENT?

In March a federal district judge in the District of Columbia ruled that the

U.S. Navy violated the Migratory Bird Treaty Act by bombing and shelling Farallon de Medinilla, an island in the Northern Marianas. The island is used by at least two dozen species of birds, a dozen of which nest there, including Great Frigatebirds (*Fregata minor*), Masked Boobies (*Sula dactylatra*), and endangered Micronesian megapodes. The Navy admitted that protected birds are killed by the training exercises, and applied to the USFWS for a permit to continue the bombing. The USFWS declined to issue a permit in 1996 but the bombing continued because the Defense Department claimed that the Migratory Bird Treaty Act does not apply to federal agencies. In an April hearing on remedy, the judge barred the Navy from conducting training exercises. The suit was brought by the Center for Biological Diversity and a birder on Guam named Ralph Frew.

The court's ruling provoked an editorial by the *Wall Street Journal* entitled "Another Bird-Brained Idea." It noted other disputes concerning bombing sites such as naval weapons testing at Vieques in Puerto Rico and disputes over the Army's use of Makua Military Reservation in Hawaii because of land snails. The editors wrote that "environmentalists have increasingly relied on courts to turn well-meaning laws into draconian ones," noting that the Navy claims it kills no more than five of each species (including eggs) annually.

The loss of training sites due to environmental regulations and decreased military training opportunities encouraged the House Armed Services Committee to include in the Department of Defense authorization bill a measure that exempts the Department of Defense from the Migratory Bird Treaty Act and the Endangered Species Act, and was included in the overall bill that passed the House by a 359-58 margin. It is unclear at this time how

the Senate will react to this provision. The National Audubon Society has suggested that if such exemptions are needed, the USFWS should decide what impact on migratory birds would be acceptable.

TOURISM VENTURE ENDS ON MIDWAY ATOLL

In spring 2002, Midway Phoenix Corporation and the USFWS dissolved their agreement to run an ecotourism destination on Midway Atoll that had been in place since 1996. This arrangement had been an attempt to blend tourism and wildlife protection in a remote part of the Hawaii Archipelago (see *Pacific Seabirds* 28:2, 2001). A small Midway Phoenix crew continued to operate the airport and utilities for the Midway Atoll National Wildlife Refuge until 1 May. Visits by tourists and volunteers were ended by Midway Phoenix in January.

White Terns (*Gygis alba*), Laysan and Black-footed Albatrosses (*Phoebastria immutabilis* and *P. nigripes*), Great Frigatebirds (*Fregata minor*), and Red-tailed Tropicbirds (*Phaethon rubricauda*) are among the seabirds that breed there. A small colony of endangered monk seals (*Monachus schauinslandi*) is resident, and threatened green sea turtles (*Chelonia mydas*) forage in the lagoon. To avoid disturbance of various species, small parts of Sand Island and all of unoccupied Eastern Island were off limits to visitors, except that tourists were allowed onto Eastern Island once a week under supervision by agency staff. USFWS and NMFS conducted monitoring and research on a number of species, and USFWS was restoring habitats, all with the help of the Oceanic Society and numerous volunteers.

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According to Midway Phoenix, it lost over \$15 million while operating Midway. \$5 million of this was borne by Boeing Corporation; Boeing's interest in Midway is an example of the surprising complexity of politics there—without an FAA-certified emergency airport on Midway, the agency would not permit two-engine airliners to fly trans-Pacific routes. Midway Phoenix staffed the airport and utilities; they also ran a hotel in some renovated military barracks, provided meal service, and subcontracted tour packages.

Midway Phoenix complained that USFWS had “managed at an extreme”—which included imposing a limit of 100 visitors per week, removing non-native ironwood trees (*Casuarina equisetifolia*), and refusing to allow activities such as kayaking or surfing. Midway Phoenix also claimed that USFWS had increased restrictions on operations during recent years. For example, most beaches were closed for the protection of monk seals, ocean-going tugs were not allowed to visit for refueling, and few cruise ships could visit.

However, according to Jerry Leinecke, supervisor of the Hawaiian and Pacific Islands National Wildlife Refuge Complex, Midway Phoenix knew and agreed to all the restrictions at the time it signed the cooperative agreement with the government. (Monk seals have begun breeding again on this formerly important atoll, with 14 pups in 2001.) Sport fishing was permitted and was lucrative for the company.

Birgit Winning, president of the Oceanic Society, said that wildlife programs would be harmed by the end of the agreement. “Not only will the endangered species and habitat recovery process be affected, so will preservation of historic sites and opportunities for long-term biological monitoring and research,” she said.

Operations on Midway currently are in a holding pattern. USFWS has contracted with the environmental firm GeoEngineers Inc. for six months to maintain Midway's infrastructure and

airport. The firm also is surveying operational costs, but it will not offer tourist services. Current residents of Midway include four USFWS employees and their families, two volunteers, and about 30 employees of GeoEngineers.

Leinecke says that USFWS hopes to re-open Midway to both tourists and volunteers by spring 2003. USFWS is currently preparing to request bids on a new long-term contract to maintain the island's facilities and provide visitor services. USFWS is considering changes that may improve their chances of success this time around. The agency would consider increasing the 100-person limit on visitors if wildlife priorities permitted it, although the number was rarely reached during Midway Phoenix's tenure. USFWS also is hoping they can defray some costs through contributions from other agencies that have interests on the island, such as the Department of Defense and the National Weather Service. On the other hand, sport fishing will be curtailed until the lagoon ecosystem has been better studied. It remains to be seen whether these conditions will attract a new company to manage Midway.

—Craig Harrison and Vivian Mendenhall

SALMON RECOVERY IN COLUMBIA RIVER MEETING FEDERAL GOALS

The Columbia River salmon recovery effort is meeting its goals, according to a joint announcement in May by the Bonneville Power Administration, U.S. Army Corps of Engineers and Bureau of Reclamation. Those federal agencies operate the river's hydroelectric dams and are meeting their goals without decimating the local Caspian Tern (*Sterna caspia*) population. Progress toward salmon recovery was made in 2001, despite it being the

second-worst water year on record for the Columbia.

In December 2000, nine federal agencies released a long-term strategy for the recovery of 12 populations of Columbia Basin salmon and steelhead listed under the Endangered Species Act. The strategy was part of a biological opinion issued by the National Marine Fisheries Service (NMFS) and involved changes in hydropower operations, habitat, hatcheries and harvest—the so-called “Four Hs.”

Actions taken during 2001 to enhance salmon recovery included improved passage of juvenile and adult fish at the hydroelectric dams, improved water quality, more fish diversions from irrigation system intakes, acquiring and protecting fish habitat, and the use of a new type of commercial fish net to reduce mortality on wild fish. The recovery effort includes fish passage improvements at the dams, downstream transportation by barge and truck of juvenile salmon, hatchery improvements and habitat improvements.

PSG COMMENTS ON CORMORANT MANAGEMENT

Thanks to PSG member Dan Roby, PSG commented in February on a draft environmental impact statement that would allow to allow states and other federal agencies to shoot large numbers of Double-crested Cormorants (*Phalacrocorax auritus*) under a general depredation order, without permits. PSG noted that Double-crested Cormorants breeding along the West Coast from British Columbia to Sinaloa, Mexico belong to the subspecies *P. a. albociliatus*. This subspecies is morphologically distinct from *P. a. auritus*, which is the common cormorant in the interior and eastern contiguous US (*auritus* is smaller and lacks the white-plumed crests of some individuals of the Pacific Coast subspecies). The size of the western population is much smaller than that the population east of

the continental divide, numbering tens of thousands of breeding pairs as opposed to hundreds of thousands of breeding pairs. Some West Coast populations have declined recently.

Unlike interior populations of *auritus*, West Coast populations of *albo-ciliatus* have not been implicated in widespread and significant damage to commercial aquaculture or displacement of other colonial-nesting waterbirds. For all of these reasons, PSG urged that the western sub-species be managed separately and that the USFWS not allow a general depredation order for west coast populations of Double-crested Cormorants. The USFWS is proceeding to propose regulations to implement a depredation order for this species, and the final rules will be timed to be issued with the final environmental impact statement. It is unclear whether PSG's comments will be implemented and the western population managed separately from the population east of the Rocky Mountains.

CASPIAN TERN MANAGEMENT IN MID- COLUMBIA RIVER

The U.S. Department of Agriculture's Wildlife Services (a predator control unit) has prepared an environmental assessment for piscivorous bird damage management for salmonids in the Mid-Columbia River Basin. The American Bird Conservancy (PSG is a member organization), the National Audubon Society, and several other conservation organizations wrote to Wildlife Services concerning the assessment. These organizations successfully sued the Army Corps of Engineers concerning the need for an environmental impact statement with regard to taking Caspian Terns in the lower Columbia River. One of the highlights of that decision is the agreement that a system-wide tern management plan—including broadly based nesting sites—must be accom-

plished within the next three years. This should include the mid-Columbia.

Wildlife Services destroyed 928 Caspian Terns in 2001 under a depredation permit, on behalf of public utility districts that manage dams in along the mid-Columbia River. The public utility districts have concerns about tern predation on threatened and endangered salmon smolts migrating through their jurisdictions. Terns, among other species (principally Ring-billed and California Gulls, *Larus delawarensis* and *L. californicus*), have been implicated as significant smolt predators. To date, little to no quantitative information exists on the diet of these birds, where they come from, or even how many there are in the system.

Of particular concern is the Caspian Tern colony in the Potholes Reservoir—the closest inland colony of terns to the mid-Columbia dams. At a mere 300 birds in 2001, this colony could sustain considerable damage if these birds are foraging within the Columbia system and subject to lethal take. The conservation groups are urging that Wildlife Services ascertain what effect Caspian Terns and other fish-eating birds are having, if any, on the return of listed salmonid species as well as other non-listed salmonids. Other species destroyed by Wildlife Services include Ring-billed Gulls, California Gulls, Double-crested Cormorants, Common Merganser (*Mergus merganser*), Western and Clarke's Grebes (*Aechmophorus occidentalis* and *A. clarkii*), and occasionally Forster's Terns (*Sterna forsteri*), Belted Kingfishers (*Ceryle alcyon*), and Great Blue Herons (*Ardea herodias*).

The American Bird Conservancy notes that while the total number of Caspian Terns nesting in the Columbia River estuary increased in 1998, 1999 and 2000, numbers of nesting terns were stable or slightly lower in 2001. In late May 2002 the Caspian Tern colony on East Sand Island had declined by almost one-quarter from the previous year and there has been no increase in Caspian Terns observed elsewhere.

PSG commented in early July 2002 on two other documents relating to Caspian Terns in the Columbia River: a draft "Status Assessment and Conservation Recommendations for the Caspian Tern (*Sterna Caspia*) in North America," by USFWS, and "Caspian Tern Predation on Salmon and Steelhead Smolts in the Columbia River Estuary," by NMFS. David Ainley wrote for PSG that the USFWS document was a thorough review, although the conservation recommendations should be made more practical. In particular, a regional survey/analysis should be done to document historical breeding sites, which sites are currently being used, and what should be done to insure a well-distributed population throughout the region. On the other hand, PSG found that NMFS's analysis of tern impacts on smolts was poorly done; it omitted much relevant research and did not support its conclusion that tern predation "significantly affects [salmon] recovery."

PSG members Julia Parrish and Chris Thompson have been contracted by the Chelan County Public Utility District to study the interactions between piscivorous birds and salmon smolts in the mid-Columbia River with a view toward assessing the actual impacts on the fish, as well as understanding the origin, age structure and other attributes of the bird populations which could contribute to intelligent ecosystem-based management.

PANEL OPENS DOOR FOR ENDING BRITISH COLUMBIA'S BAN ON OFFSHORE DRILLING

An expert panel appointed by the British Columbia government concluded in May that there is no scientific reason to maintain a decades-old ban on drilling off the province's shores. PSG wrote British Columbia Minister of Energy and Mines Richard Neufeld in 2001 asking that the government agencies proceed very carefully with any plans to exploit those resources

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(*Pacific Seabirds* 28:71, 2001). The three-member panel of scientists concluded: "There is no inherent or fundamental inadequacy of the science or technology, properly applied in an appropriate regulatory framework, to justify retention of the ... moratorium."

The moratorium has been in place since 1959. It was temporarily lifted in 1966 to permit the drilling of exploratory wells. In 1972, Canada's federal government, which has jurisdictional precedence in the development of offshore resources, re-invoked the moratorium. The panel did not recommend lifting the ban, only studying the idea further.

Many British Columbia officials seem keen to spark economic growth in coastal communities, but there are strong objections from conservation organizations and hesitation on the part of Canada's federal government. Even more problematic may be that fact that energy companies with long-stagnant leases in the region do not plan to exercise them unless aboriginal land claim disputes are cleared up and other major problems resolved. The Charlotte Basin has drawn the most interest from the oil and gas industry and could contain 10 billion barrels of oil and 26 trillion cubic feet of natural gas.

CANADA REQUIRES HALIBUT FISHERY TO IMPLEMENT SEABIRD BYCATCH TECHNIQUES

Last year, PSG wrote Canada's Minister of Fisheries and Oceans to urge it to develop and implement a national plan of action to reduce the incidental take of seabirds in longline fisheries (*Pacific Seabirds* 28:71, 2001). We had heard from our Canadian colleagues that the group that had been assigned this task was unofficially called the "non-working group." In May 2002, the Minister of Fisheries and Oceans wrote to summarize the efforts to date and to announce that beginning March 2002 the halibut fleet in the Pacific is required to adopt

methods to reduce seabird bycatch. In addition, the sablefish and rockfish fisheries on the Pacific coast are expected to be required employ techniques to reduce seabird bycatch soon.

NEW TECHNOLOGY MINIMIZES SEABIRD DEATHS IN HAWAII LONGLINE FISHERY

Albatrosses and other seabirds are drowning by the thousands after being hooked and drowned in the world's longline fisheries. Many of the world's albatross species are now considered to be seriously threatened, with longlines being the major threat. As these developments indicate, effective and inexpensive solutions exist for most fisheries. The American Bird Conservancy (PSG is a member organization) recently released a new report on seabirds and longlines: <http://www.abcbirds.org/policy/seabirds.htm>.

A new device which keeps fish bait and hooks out of sight of birds may help avoid mortality of albatrosses and other seabirds in the Hawaii tuna longline fishery. The equipment, called an underwater chute, enables longline fishing vessels to catch tuna and swordfish without killing the thousands of albatrosses that get caught on baited hooks and drown each year. The birds get hooked or entangled when gear is being set and are dragged underwater and drown as the fishing gear sinks.

First developed in 1995, the underwater setting chute releases baited hooks underwater, out of sight and reach of these diving seabirds. It has been tested in New Zealand and is undergoing trials in Australia's tuna longline fisheries. The results of recent Hawaii tests indicate when setting under controlled conditions without the underwater setting chute, seabirds contacted 6.5% of baited hooks set, resulting in the mortality of 24 seabirds. When setting with the chute, seabirds contacted 0.2% of baited hooks set, and no birds were caught or killed. According to Jim Cook, owner

of the fishing vessel *Katy Mary* and representative of the Hawaii Longline Association, "The data indicate that the chute is effective at avoiding seabird interactions with longline gear in the Hawaii fleet. And, equally important, the longline industry is likely to support use of the chute, as it promises to save fishers money by reducing bait loss, and does not require significant alteration of normal fishing practices." The chute may resolve seabird bycatch problems in the Hawaii tuna fishery, and if the Hawaii swordfish fishery (closed in 1999 due to concerns over sea turtle mortality) resolves their turtle bycatch problem and is allowed to resume, the chute may be effective at avoiding seabirds in this fishery as well.

PSG SUPPORTS NORTHWESTERN HAWAIIAN ISLANDS CORAL REEF ECOSYSTEM RESERVE

Thanks to PSG member Mark Rauzon, PSG provided comments on draft reserve operations plan for the new marine sanctuary in the Northwestern Hawaiian Islands, suggesting that seabirds should figure prominently in the management of this reserve. PSG corrected errors in the draft list of breeding seabirds, and suggested that the reserve develop a list of all seabirds that commonly occur in the marine area. PSG supported most of the proposed directions in management, including marine debris cleanup, public education and regulation of bottom fishing at submerged banks. PSG also encouraged seabird monitoring in the offshore sanctuary, and improved enforcement in these remote waters.

STATUS OF CONSERVATION AND REINVESTMENT ACT

The efforts for federal funding of state wildlife work continue apace. Since the failure of the Senate to pass the CARA bill (Conservation and Reinvestment Act) in the last Congress (in late 2000), the drive has been taking two tracks. First, there has been an inconsistent effort to get the states yearly appropriated funding. It has been relatively successful, with \$50 million and \$80 million available in Fiscal Year (FY) 2001 and FY 2002, respectively. Unfortunately, the requirements and standards for the two years have been different, creating all kinds of problems in getting the states to comply. At this moment it is unclear what the amount may be for FY 2003. Second, there continues the effort to get CARA or something close to CARA (with long-term or permanent funding included) passed. The House Resource Committee marked up CARA months ago, but the bill has yet to go to the House floor. At the same time, the Senate's passage of the excellent American Wildlife Enhancement Act, S990 (a good bill but without permanent funding) is hopeful. These two bills present an important opportunity to enact dedicated conservation funding—to support wildlife conservation and related wildlife education and wildlife recreation—during this Congressional session. We may yet get one or the other bill passed, or a combination with elements of both. Meaningful state participation on varied aspects of bird conservation may very well depend on the outcome of this situation.

—Paul J. Baicich

EFFORTS CONTINUE TO LOCATE BAND-RUMPED STORM-PETREL NESTS ON KAUAI

The search narrows as researchers have located a remote predator-free valley that holds a colony of Band-rumped (Harcourt's) Storm-Petrels (*Oceanodroma castro*)—the only Ha-

waiian seabird whose nest remains thus far undetected. David Kuhn reports that during 2001 he continued his attempts to find a nesting colony of Band-rumped Storm-Petrels on Kauai. He and others continue to hear and record calls every 5-15 seconds from 2000 to 2130 hours in June, in extremely rugged terrain at about 3000 feet near Waimea Canyon Lookout. He also listened at stations over a wide area and heard storm-petrels throughout the upper Waimea Canyon, from Waimea Canyon Lookout 6 miles northeast to Poomau Canyon, and north to Kalalau Valley. Calls continued until mid-October. Kuhn is continuing his efforts in 2002.

During a late August 2001 botanical research visit within the hanging valley of Pohakuao, Ken Wood, National Tropical Botanical Garden, was fortunate to find himself camped amidst nesting populations of Band-rumps and Newell's Shearwaters (*Puffinus newelli*). This was the first confirmation of a Band-rump breeding site in Hawaii, although the actual nest still defies detection.

CHRISTMAS ISLAND RATS

The appearance of ship rats (*Rattus rattus*) at Kiritimati (Christmas Island, Pacific Ocean) is bad news indeed. Their arrival was predicted in 1986 by Ian Atkinson, who foresaw catastrophic environmental and economic damage when ship rats reached Kiritimati. Already Pacific rats (*R. exulans*) plague the seabirds on the remaining seabird colonies there. Ship rats apparently arrived about three years ago either from copra shipments from nearby Fanning Island or in Japanese heavy equipment. This development will speed the decline of seabirds, which already are pressured by human population growth. Ship rats will make feral cat control even more difficult, and make the loss of the Christmas Island warbler more likely.

PSG members William T. Everett and Mark Rauzon visited the island in

January 2002 and have developed a conservation plan for saving remnants of the once tremendous seabird population. They propose working on the small islets where Phoenix Petrel (*Pterodroma alba*) and Polynesian (White-throated) Storm-Petrel (*Nesofregetta fuliginosa*) exist, and where Pacific rats are easy to eradicate.

PSG members Tara Zimmerman, Holly Friefeld and Kent Wohl will attend the South Pacific Regional Environmental Programme meeting in the Cook Islands in July to explore a USFWS effort to implement the priorities in the Environmental Programme's plan, including projects on Christmas Island. Already the Environmental Programme is supporting the efforts of New Zealanders in eradicating Pacific rats from a small islet where Phoenix Petrels attempt to nest.

RATS REMOVED FROM HELEN ATOLL, PALAU

PSG member Mark Rauzon consulted with Michael D. Guilbeaux of the Community Conservation Network in Hawaii concerning rat control. Guilbeaux reports that rat poisoning under the guidance of the Palau Department of Sanitation occurred in late 2001. One month after initial deployment, no rats were caught by ten traps set out on each of six consecutive nights. Officers who have since visited the island claim they have not seen even one rat, and that bird populations are getting bigger.

Helen Reef is a 162 km² coral reef atoll situated between the Palau archipelago in Micronesia and insular Southeast Asia. This large remote coral reef atoll is unparalleled in Palau and Micronesia in terms of its ecological integrity, abundance, and biological diversity. It provides habitat for many renowned and critical wildlife populations. Helen Reef historically supports some of the largest known nesting seabird colonies in Micronesia, all of which are threatened, to a greater or lesser extent, by alien rats. These colonies include pan tropical seabirds and

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important colonies of Great Crested Terns (*Sterna bergii*) and Black-naped Terns (*S. sumatrana*). The rare coastal nesting population of the Great Crested Tern at Helen Atoll is thought to be one of the largest colonies remaining in the entire Pacific Ocean. In addition, regionally important foraging and nesting populations of Green and Hawksbill sea turtles (*Chelonia mydas* and *Eretmochelys imbricata*) may benefit, as rats have attacked hatchling turtles.

Future monitoring will be necessary to determine whether rat eradication was complete.

METHUSELAH LAYSAN ALBATROSS MOM

Chandler S. Robbins recaptured a Laysan Albatross on Midway Atoll in February 2002 that he had initially banded in 1956. This bird was incubating an egg when he first banded it, indicating that it was at least five years

old at the time. Robbins had replaced the worn band in 1962, and other colleagues had replaced it again in 1985 and 1993. When he gave this bird its 5th sequential band in February 2002 it was at least 51 years old—and was brooding a healthy chick. This breaks the longevity record for North American birds in the wild, the previous record being for this same species at the age of 42 years 5 months.

PSG NEWS

PSG ELECTS EXECUTIVE COUNCIL FOR 2002

The following members of the Executive Council were elected in fall 2001:

Officers:

- Chair-elect: David Irons
- Secretary: Lora Leschner

Regional Representatives:

- Alaska/Russia: Verena Gill
- Northern California: Meredith Eliot
- Old World: Mark Tasker
- Pacific Rim: Beth Flint
- Student Representative: Stephani Zador

A complete list of Executive Council members is on the inside back cover.

Thirty percent of all members voted. Among the regions, the Old World and Hawaii/Pacific Rim trailed the pack at 21% return; Alaska/Russia topped all, with 49% return of ballots (although no votes came back from Russia). Perhaps the Regional Representatives can muster more enthusiasm within their ranks for voting, or else they could propose more alternate candidates. However, the one Region with two candidates, Northern California, ran a poor next-to-last showing with only 23% of ballots returned.

Some of the races were quite close, with only one vote separating the two candidates. Therefore, I encourage all who did not get elected this year to run again in the future. There were a few write-in candidates; I will circulate their names to the appropriate Representatives, who can contact them and ask if they want to run next time.

Thank you all for your help in selecting the slate of nominees. It was a great line-up of candidates.

EXECUTIVE COUNCIL CANDIDATES NEEDED FOR 2003

The following positions will be up for election in fall 2002:

- Chair-elect
- Vice-chair for Conservation
- Treasurer
- Southern California representative
- Oregon-Washington representative
- Non-Pacific US representative
- Canada representative

PSG needs candidates who would like to serve in these positions. Being a member of the Executive Council is extremely interesting. You can keep up on current issues surrounding seabirds, and you are helping PSG maintain its prominent role in seabird conservation.

Students are invited to become candidates for any position on the Executive Council. Only one position is restricted by academic or professional standing: that of Student Representative, who must be a student.

APPOINTMENT OF CHAIR FOR PSG's PUBLICATIONS COMMITTEE

PSG is pleased to announce the appointment of Pat Jodice for this position. As Publication Committee Chair, Dr. Jodice will oversee the production of PSG publications, and will sit on the board of Marine Ornithology. You may reach him at jodicep@ucs.orst.edu

PSG's 2003 MEETING TO BE HELD IN PARKSVILLE, BRITISH COLUMBIA

PSG will hold its 30th meeting in Parksville, British Columbia, at Tigh-Na-Mara Resort (the name is Gaelic for

"By the Sea"), on 19-22 February 2003. Parksville is on Vancouver Island, 30 minutes north of Nanaimo and 2 hours north of Victoria by road. Visitors can fly to Vancouver, Victoria or Seattle and take the BC or Washington State ferry systems to Nanaimo or Victoria. The meeting will take place on site. There are several varieties of accommodation; many have kitchenettes. There is also a fine restaurant at the resort. The web site for Tigh-Na-Mara is www.tigh-na-mara.com.

The Local Organizing Committee is Doug Bertram, Shelagh Bucknell, Neil Dawe, Bob Elner, Mark Hipfner, and Ron Ydenberg. We look forward to seeing you at the 30th meeting in Parksville, BC.

AWARD NOMINATIONS NEEDED

Since 1993, PSG has given occasional awards for outstanding contributions to seabird research, conservation, or education. The Lifetime Achievement Award recognizes significant, long-term contributions to seabird science, conservation and education in the Pacific Ocean or the world. The Special Achievement Award is given for a single outstanding accomplishment or for service to PSG. Past recipients of both awards are listed at the end of this issue.

The Awards Committee would like to receive nominations for either award from any member. In order to nominate someone, send a one-page letter to the coordinator of the Awards Committee, explaining the reasons for your nomination. (The committee Coordinator for 2002 is Bill Sydeman; phone (15) 868-1221, extension 19; e-mail wjsydeman@prbo.org).

The Awards Committee and Executive Council will vote on the nomination. If your candidate is accepted,

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you will be asked to plan the presentation of the award at the annual meeting, and to write a brief article (photos included) for *Pacific Seabirds*.

KARL KENYON NO LONGER ABLE TO RECEIVE *PACIFIC SEABIRDS*

The editor received the following letter on behalf of Karl Kenyon:

02/13/02

I am writing this note at the request of Karl W. Kenyon (please see enclosed magazine mailing address). Because Karl is 83 years old, in failing health and has lost his eyesight he has decided he no longer wishes to continue receiving *Pacific Seabirds* and hopes that the funds remaining for his subscription can be better used to further scientific research.

Sincerely, Clarence Larson (ATF/POA) for Karl W. Kenyon.

Karl is a lifetime member of PSG. He was honored with PSG's very first Lifetime Achievement Award in 1993 (*Pacific Seabirds* 21:16, 1994). He pioneered colony surveys in Alaska, management of seabird-aircraft conflicts, and beached bird surveys; he did among the earliest research on ingestion of plastic by seabirds and the homing abilities of albatrosses. His other talents have included research on marine mammals, piloting Navy fighter planes in the Pacific during World War II, and painting. Until recently he has attended PSG's annual meetings faithfully.

JAPAN SEABIRD SYMPOSIUM PAPERS PUBLISHED

Five papers from the joint symposium of PSG and the Japanese Seabird Group at Kihue, Hawai'i, in February 2001 have been published in the *Journal of the Yamashina Institute for Ornithology*. The papers are in volume 33, number 2 of the journal: Watanuke et al., "Biology, status, and conservation of Japanese seabirds" (introduction to the symposium); Carter et al., "Status and conservation of the Japanese Murrelet in the Izu Islands"; Nelson et al., "The status and conservation of the Long-billed Murrelet in Japan"; Osa and Watanuki, "Status of seabirds breeding in Hokkaido"; and Lee and Yoo, "Breeding population of Streaked Shearwaters and the effect of Norway rat predation on Sasudi Island." Seabird papers are on pages 57-147; papers on other subjects occupy the rest of the issue, pages 148-213. All papers are in English with Japanese abstracts.

A few copies of the journal containing the symposium papers are available through the PSG treasurer for \$75 each.

PSG HANDBOOK AVAILABLE

The PSG Handbook is now available for use by PSG members. This handbook was prepared primarily for PSG officers, regional representatives, committee coordinators, and Annual Meeting organizers. However, it will also be useful for any PSG member who wonders how PSG functions. The handbook includes PSG's Bylaws, the responsibilities of Executive Council members, information on our journals, *Pacific Seabirds* and *Marine Ornithology*, and step-by-step directions on how to put on an annual meeting. If you have ever considered running for an Executive Council position, hosting an annual meeting, or becoming more involved in PSG, this document should answer your questions about roles you

could play in the organization and potential responsibilities. The handbook was written over a period of four years by Kim Nelson and Amanda Wilson, with input from the Executive Council and the Annual Meeting local committees. It will be revised yearly, as needed, by the Secretary of PSG (currently Lora Leschner).

Please read the handbook and provide suggestions or additions. You will find a copy soon at PSG's web page (<http://www.pacificseabirdgroup.org>); in the meantime, you can request a copy from Lora at leschl11@dfw.wa.gov.

SEADUCK CONFERENCE AND WORKSHOPS

The North American Sea Duck Conference and Workshop will be held in Victoria, British Columbia, on 6-10 November 2002. Sponsored by Sea Duck Joint Venture partners, this meeting will gather researchers, managers, and administrators with an interest in sea duck biology and conservation. The goal is to provide a focal point for initiating and furthering the goals of the Sea Duck Joint Venture. Activities will include science presentations to define where we are in our understanding of sea duck biology and population status, and there will be workshops on specific issues. For more information, or to propose workshop topics or special sessions, please check out the web site: (www.seaduckjv.org/conference). You may also contact Dan Esler, Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, BC V4K 3N2, Canada; e-mail seaducks@sfu.ca

NEWS OF THE PACIFIC SEABIRD GROUP'S ANNUAL MEETING OF 2002

The 29th Annual Meeting of the Pacific Seabird Group was held at the Santa Barbara Museum of Natural History on 20-23 February 2002. This section contains short reports on the meeting. Elsewhere in this issue are longer reports on the Santa Barbara Island field trip, Lifetime Achievement Award, Executive Council meeting, and committee activities, plus abstracts of the papers and posters.

OVERVIEW OF THE MEETING

PSG's 2002 Annual Meeting combined an elegant setting with a high-caliber scientific program. The meeting was attended by 252 people, 52 of whom were students.

Sessions were held at the Santa Barbara Museum of Natural History. The meeting was anchored by three plenary lectures: "Relative survival of some hypotheses in seabird biology," by Philip and Myrtle Ashmole; "Why murre biologists might want to know more about Adélie Penguins," by David Ainley; and "Aggressive competition among broodmates," by Hugh Drummond. There were two symposia: "Biology and conservation of American White Pelicans" and "Oil and California's seabirds." A total of 100 papers and 40 posters were given, including 35 student presentations.

Committees and the Executive Council met on 20 February, and the editorial board of *Marine Ornithology* met on 23 February with South African editor John Cooper.

A special tribute was held on 22 February at the Radisson Hotel for Steve Speich, PSG's long-time editor and Publications Chair who died in December 2001. Ron LeValley, Bob Pittman, and many others contributed reminiscences of Steve; Pat Baird read poetry. Malcolm Coulter recorded the presentations for the benefit of Steve's family.

Coffee breaks, lunch, and the evening poster session were held on the

beautiful patios of the Spanish-style museum. The annual banquet on 23 February took place at the Santa Barbara Maritime Museum; PSG's Lifetime Achievement Award was given to Philip and Myrtle Ashmole. Both museums made their exhibits available to us after hours.

Several field trips went to the Channel Islands National Park—Santa Barbara, Santa Rosa, Anacapa, and Santa Cruz Islands. Trips were also arranged to the Sespe Condor refuge, the Western Foundation of Vertebrate Zoology, and the Salton Sea. The weather was idyllically warm and sunny, although Californians might have preferred rain to break the drought.

The Local Committee consisted of Harry Carter and Sarah Fangman (co-leaders), Mark Pierson, Cathie Dunkel, Mike McCrary, Paige Martin, Gerry McChesney, Bill McIver, John Mason, and Pam Barnes. Lisa Ballance was Scientific Program Chair. Major support was received from the Santa Barbara Museum of Natural History, the Santa Barbara Maritime Museum, Channel Islands National Marine Sanctuary, Channel Islands National Park, U.S. Minerals Management Service, U.S. Geological Survey, and Humboldt State University. PSG thanks all of them for an outstanding meeting.

STUDENT TRAVEL AWARDS FOR PSG'S 2002 MEETING

Funds were generously donated by the Channel Islands National Marine Sanctuary and U.S. Geological Survey to help students who were presenting papers or posters to attend the meeting. Awards of \$200-\$500/person were given by the Local Committee to Russell Bradley, Eli Bridge, Morgan Benowitz-Fredericks, Tomohiro Deguchi, Christine Hamilton, Christina Maranto, Catherine Murra, Martin Renner, Julie Thayer, Ignacio Vielhis, Lucy Vlietstra, Francis Wiese, and Carlos Zavalaga.

STUDENT AWARDS FOR PAPERS AND POSTERS

At every PSG Annual Meeting, the Awards Committee and several volunteer judges determine the best student paper and poster, plus a runner-up in each category. Usually at least two people judge each presentation, and final decisions are reached in a conference among all judges.

At the 2002 meeting, the best student paper was: Nina Karnovsky, Jan Marcin Weslawski, Slawik Kwaniewski, and Wojtek Walkusz, "The foraging behavior of Little Auks in a heterogeneous environment." The best student poster was: Jaime Jahncke, K. David Hyrenbach, Cheryl L. Baduini, Kenneth O. Coyle, and George L. Hunt, Jr., "Distribution of foraging shearwaters with respect to the inner front of the southeastern Bering Sea."

So many good papers were presented by students that two runners-up were chosen: Jaime Jahncke, David

PSG ANNUAL MEETING

Checkley, and George L. Hunt Jr., "Long term-trends in carbon flux to guano-producing seabirds in the Peruvian upwelling system," and Christina Maranto, "The influence of food quality on reproductive performance in an arctic tern population." The runner-up for best poster was Alexis Blackmer, "The effect of investigator disturbance on the reproductive success of a long-lived seabird"

PSG congratulates the winners of these awards. Students presented many high-quality papers and posters, which contributed greatly to the caliber of the meeting.

More information on student awards is available from the Chair of the Awards Committee.

RESPONSE TO PARTICIPANT QUESTIONNAIRE AT PSG'S 2002 MEETING

Compiled by Lisa T. Ballance and Joshua Fluty

This year the local and scientific committees for PSG's 29th Annual Meeting composed a questionnaire so that all participants could make their opinions known. Approximately 260 persons registered; 50 questionnaires were returned. The responses are summarized below.

Did you attend the 28th annual meeting in Kauai, Hawaii?

Yes—29

No—21

Other—0

How many days did you attend the 29th annual meeting in Santa Barbara?

1 day—0

2 days—1

3 days—14

4 days—22

5 days—10

Other—3

Do you plan to attend the 30th annual meeting on Vancouver Island, British Columbia?

Yes—36

No—2

Other—12

Do you think you received a reasonable value for your registration fee?

Yes—42

No—1

Other—7

If a secure web site were available, would you use it to pay registration fees by credit card?

Yes—32

No—16

Other—2

Did you find the abstract submission process via the web site useable?

Yes—30

No—0

Other—20

Did you receive sufficient information via the web site without paper mailings?

Yes—47

No—2

Other—1

Did you attend a pre-conference committee meeting?

Yes—24

No—26

Other—0

Did you like having Plenary Speakers and were there too many, too few, or just right?

Too many—6

Too few—0

Just right—42

Other—2

Was there sufficient space to view the posters?

Yes—29

No—9

Other—12

Did you like having a dedicated time to view posters?

Yes—46

No—0

Other—4

Did you like having Symposia and were there too many, too few, or just right?

Too many—2

Too few—1

Just right—36

Other—11

Did you like having social events/mixers and were there too many, too few, or just right?

Too many—1

Too few—0

Just right—47

Other—2

We also encouraged general comments on all meeting-related topics. These fell into the following categories:

Location: All comments on the location of the meeting were positive. Many preferred this location to a convention center or hotel venue. However, one person preferred that everyone stay at a single hotel to facilitate networking. A few suggested that more accommodation options, especially lower-cost options, would have been helpful.

Transportation: A few commented on problems with the bus schedules and some requested more flexibility with respect to pick-up and drop-off times. Some suggested that a local bus schedule be included in the meeting packet.

Program: Many commented that the format and design of this year's printed program were the best in many years. There were a number of requests to return to the format of 15 minutes for presentations plus 5 minutes for questions. Some noted that the pace of the meeting felt hectic and that the session chairs' attempts to stay on schedule were often not successful, contributing to the problem. A large number of respondents commented that they enjoyed how well-organized this meeting was.

Posters: Several suggested that a room separate from that in which oral papers were heard would be better for poster display. Some requested more dedicated time with authors and a number would have preferred all posters to be in the same room, along with food and drink during the mixer.

Audio-visual: A number of respondents noted the importance of a dedicated A/V person and requested that all rooms in which oral papers were given be assigned such a person. There were requests that a remote control be available for all LCD projectors.

Food: Most agreed that the quality of the food was outstanding, but a few

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commented that lunch and the banquet were over-priced. Some requested that coffee be available at the start of each meeting day.

Symposia: A few commented on the narrow, local focus of this year's symposia. Others thought the topics timely and valuable.

Tote bags: All who commented loved them.

Our thanks go to all of you who returned the meeting questionnaire. We hope to make this a regular part of the

annual meeting, so please plan to give us your comments at the end of next year's meeting.

PSG T-SHIRTS FOR SALE

If you forgot to buy your T-shirt at the Santa Barbara meeting, or you weren't able to attend, you are in luck. Leach's Storm-Petrel T-shirts (white, short-sleeved; L, XL, and XXL sizes only) cost \$12 each, and can be ordered

from Harry Carter (707-678-0682, ext. 625; Harry_Carter@usgs.gov). White Pelican t-shirts (black, short-sleeved; L and XL sizes only) cost \$15 each; White Pelican sweatshirts also are available (black, long-sleeved; L and XL sizes only) for \$25 each. White Pelican shirts can be ordered from Dan Anderson (530-752-2108; dwanderson@ucdavis.edu). All prices include shipping.



T-shirts from the 2002 Annual Meeting—for sale! See article on this page.

SECRETARY'S REPORT

SUMMARY OF PROPOSED MINUTES OF THE 2002 PACIFIC SEABIRD GROUP EXECUTIVE COUNCIL MEETING

Santa Barbara Museum of Natural History, Santa Barbara, California, 20 February 2002

[The full text of the proposed minutes is available from the Secretary, **Lora Leschner** (leschl11@dfw.wa.gov). The minutes will become official when they are approved at the 2003 Executive Council meeting.]

The 2002 meeting of the PSG Executive Council (Council) was called to order at 9:35 AM. Present were Bill Sydeman, Lisa Ballance, Craig Harrison, Julia Parrish, Lora Leschner, Breck Tyler, Vivian Mendenhall, Ken Morgan, Jan Hodder, Kyra Mills, Pat Mock, Malcolm Coulter, and Rob Suryan. Absent were Elizabeth Flint, Mark Tasker, and Louise Blight; Ballance had Tasker's proxy.

Minutes

The minutes from the 2001 meeting were approved.

Report from Chair—Bill Sydeman

The Chair worked on getting the endangered species petition for the Xantus's Murrelet into final preparation. The incoming chair, Lisa Ballance, will draft a cover letter and submit the petition to the U.S. Fish and Wildlife Service and the California Department of Fish and Wildlife in next 2 or 3 weeks.

Other issues that the Chair worked on included the future of *Marine Ornithology*, future meetings, and the PSG web site.

PSG website

Bill Sydeman asked the webmaster, Ben Saenz, to give an update on the web site. Abstracts in *Pacific Seabirds* could be put on web. The publications committee will discuss the options.

The Seabird Gallery takes time to update. PSG needs to be clear on

copyrights. Ken Morgan will contact current contributors and ask if it is OK to use the photos. Ben, Bill and Ken will work on a policy statement.

It was suggested to add to duties of regional representative in the by-laws the action that they update information on the web and keep the web master informed of regional activities.

The local committee for the Santa Barbara meeting put information on the web and then sent postcard to the members. Executive Council members supported this method of registration and received no complaints from members. Ben can be reached at the Web comments e-mail address. The Executive Council and members can send additional comments. Links page—Members should submit ideas for additional links.

Treasurer's report—Breck Tyler

Breck referred to the Treasurer's Report in *Pacific Seabirds* 28:101 (fall 2001).

There was a question about operating income. The answer was that operating income appears to have dropped, but actually it is fairly stable. PSG made some profit on meetings and spent that income with one-time expenditures.

Accounts for the annual meeting in Hawaii still are not complete; there has been some problem in reporting. The Treasurer has submitted requests to local committees many times—he knows the bottom line for previous meetings, but he still lacks details from several. The Council suggested that the reporting process for accounts of annual meetings needs to be formalized.

[See "Meetings—general," below, for reports by local chairs to the Council.]

The Executive Council adopted the proposed budget of \$10,600 for 2001-2002.

Breck Tyler announced that he will not run for re-election as Treasurer, so the Council needs to recruit a new Treasurer for the 2003 elections.

PSG Handbook—Kim Nelson.

Nelson presented the latest version of the PSG handbook. A discussion followed on important things that should be included in the handbook. The Council thanked Kim for all her work to gather the information together that keeps PSG organized.

The handbook was passed to Secretary to maintain.

COMMITTEE REPORTS

Xantus Murrelet committee—Bill Everett

This is the 10th anniversary of the Xantus murrelet committee, which represents 10 years of pondering what to do about this rare species. PSG provided funding to complete and prepare a report on its status. The committee is ready to move forward. The weakness in the report is the huge gaps in information. The latest version of the petition has more documentation and less advocacy. The Executive Council has the power to revise and send it out. However, this is just a first step; after receiving the petition, the agencies have to do the remaining work. PSG needs to put the petition on the web site. However, the document is not to be distributed or cited until the Chair issues the final version.

SECRETARY'S REPORT

The Council voted to accept the revision and submit the Endangered Species petition.

Bill Everett stated that committee's goal of producing the petition has been met and recommended that the Executive Council consider eliminating the committee. The Council voted to keep the committee in place for at least one year to help answer questions about the petition.

A discussion on PSG committees followed. Committees provide answers to specific questions from the Executive Council; any statement from other organizations should come through the Executive Council.

Awards Committee—Julia Parrish

The Council voted to approve the Lifetime Achievement Award for Phillip and Myrtle Ashmole.

PSG's awards were defined. The Lifetime Achievement Award is given for an entire body of work and multiple activities—e.g., the Ashmoles have published a number of papers which are cited widely, spoken to many people, and put seabirds in evolutionary context. The Special Achievement Award is given for specific accomplishments—service to PSG, or one major achievement in seabird work.

To nominate someone for an award, you should submit a one-page letter to the Awards Committee (its chair is the Past President). If the award is approved, you are responsible for planning the introduction at the annual meeting, and for writing a brief article (photos included) for *Pacific Seabirds*.

Conservation Committee—Craig Harrison

Six letters were sent by PSG to comment on seabird issues during the past year. A report on conservation activities was submitted to *Pacific Seabirds*.

Publications committee

The position of chair is vacant. Bill Sydeman gave a brief report of activities and then referred the

publications committee discussion to a later meeting date. PSG agreed in a previous year to support *Marine Ornithology* for 3 years. A sub-committee was formed to evaluate options for the journal.

The Secretary will work with the Editor to print a hard copy of the membership list in an issue of *Pacific Seabirds*.

Editor's report—Vivian Mendenhall

The editor encourages people to submit short articles and notes. Regional representatives should try to expand regional reports. Chair referred additional discussion to publications section. The editor requests that people submitting information to *Pacific Seabirds* should provide definitions for acronyms.

Mendenhall reported that she has investigated cost saving features offered by the U.S. Postal Service.

Election Committee

The committee chair, Pat Baird, was absent. Lisa Ballance read Baird's report on the 2001 PSG election. The following people were elected: Chair elect—David Irons; Secretary, Lora Leschner; Alaska representative, Verena Gill; Northern California, Meredith Elliot; Old World, Mark Tasker; Pacific Rim, Beth Flint.

Only 30% of members voted. Alaska and Russia voted the highest. A discussion followed on how voter turnout could be improved.

Marbled Murrelet Technical Committee—Anne Harfenist

The last revision of the inland survey protocol was in 2000. In 2001, PSG sent out letter saying there were no changes in the protocol. The committee advises that PSG should send out a letter in 2002 directing surveyors to use the 2000 protocol. The letter should advise that a new protocol should be available for 2003 and to consult the web site for additional information.

Harfenist described the activities of four sub-committees. A more extensive report on committee

activities will be in *Pacific Seabirds* 29(1), spring 2002.

The Council discussed improved communication. They voted to request quarterly reports of activities from the Marbled Murrelet Committee, and to receive the latest version of the Inland Survey Protocol by 15 October 2002 for Council review.

Japan Seabird Conservation Committee—John Fries

Several papers from PSG's Japanese Seabird Conservation symposium last year in Kauai will be published in the Journal of the Yamashina Institute for Ornithology.

The committee has been working to develop a Japanese version of the U.S. Fish and Wildlife Service's "Learn About Seabirds" curriculum. The Hokkaido Seabird Center will work to distribute the materials to schools.

The committee is working on a seabird colony catalog database.

Committee members continue to work on improving the conservation of seabirds in Japan. They are working with the US and Japanese governments via the Convention on Migratory Birds and are advocating international agreements and projects.

The Japanese Seabird Committee is important because it links PSG with seabird issues in Japan and lends our support to seabird conservation there. The Council voted to designate the Japan Seabird Committee as PSG's formal link with the Japanese seabird research community.

Seabird Monitoring Committee—Scott Hatch

Hatch discussed the progress of the monitoring database. Three things are necessary: (1) the database should be consolidated and served on a PC, (2) an arrangement should be continued with a web database developer to update the site; (3) a database administrator should be hired to oversee the pelagic database, seabird diet database, and colony catalog. Scott sees a need to fund the position for the future.

SECRETARY'S REPORT

The Council voted to ask the Monitoring Committee chair for a written report. Recommendations to the Council should include a proposal and cost analysis for PSG to maintain the existing monitoring database. A committee report will also be published in *Pacific Seabirds* 29(1).

MEETINGS

2002 meeting—Lisa Ballance

There will be 100 verbal presentations and 40 posters, including 35 student presentations. Registration was 220 on Monday. The Symposia should be well attended. Many people are coming to the meeting just for the White Pelican symposium. The latest budget forecast had projected a profit.

Future meetings

The 2003 meeting will be in Parksville, British Columbia, in February 2003.

The proposed meeting location for 2004 is La Paz, Mexico. Dan Anderson is working with other members on the details.

Local Committees for meetings

The Council discussed goals and budgets of annual meetings. One of the suggestions was to have a standing committee on annual meetings. Local committees should continue to negotiate for reduced prices on meeting space and accommodations. The committee should support costs for invited guests; the Executive council supports costs for award recipients.

The Council voted some requirements for local committees: (1) Each local committee chair must develop a budget. Proposed income for the meeting will be based on the median of attendance figures for the last 5 years, both student and full members. The draft budget will be

submitted to the PSG Chair, according to a schedule that will be in the PSG handbook. (2) The local committee will have discretionary ability to waive registration fees for up to 10 attendees. A higher number of waivers would require approval of Chair.

The Council discussed additional support for students. The Student Representative should have the duty of looking for ways to provide additional support. If outside funds for student travel are obtained by the local committee, then the funding agency and the local committee are responsible for distributing the funds. If PSG sponsors student awards, PSG decides who will receive them, through the awards Committee and the Council.

The meeting adjourned at 5:30 PM.

COMMITTEE REPORTS

SEABIRD MONITORING COMMITTEE

Scott A. Hatch, Committee Coordinator

During the past year, the Pacific Seabird Monitoring Database (PSMD) project contracted with a software developer in Boise, Idaho, to write a data entry application for use over the World Wide Web. In the future, contributors to the PSMD will log in to a password-protected website to enter their seabird monitoring data records, and to submit, retrieve, and edit them. The application provides for efficient interaction with a Database Administrator, who will be responsible for managing the process and reviewing new data prior to release. Records will be held in a "staging" database until they are approved for inclusion in the distributed version of the PSMD. This data entry application will complement the software developed last year (under contract with Environmental Systems and Research Institute, Inc.) for web-based query, mapping, and downloading of data from the PSMD.

Other activity during the year included peer review of previously contributed data through a process established at the PSG annual meeting in Lihue (February 2001).

The Committee believes that future maintenance of the PSMD requires three elements of infrastructure. These requirements may be contracted from commercial sources or contributed by partnering organizations in the PSMD project. Requirements include:

- The continuing services of a programmer able to deal with bugs, enhancements, and upgrades to the software, as dictated by evolving user needs, operating systems, and the Internet
- Suitable hardware and system maintenance for serving the database on the Web—services which should be

rendered by a government agency or a commercial web-hosting company

- A Database Administrator to coordinate activities and address the needs of data contributors, the system programmer, the Internet service provider, and PSMD clients.

Arrangements are now being sought to fulfill the functions previously discharged by Charla Sterne, who took another job in February 2001. The Committee's goal is for the PSMD to be fully operational and accessible via the PSG website within the calendar year.

The Committee envisions and encourages implementation of the PSMD as part of a larger Internet-based system of seabird databases. This database system would include a consolidated colony catalog, pelagic survey database, and food habits database for Pacific seabirds. The sum of all four databases will be a comprehensive and continually updated repository of key results from seabird research and monitoring in the North Pacific.

MARBLED MURRELET TECHNICAL COMMITTEE

Anne Harfenist, Committee Coordinator

The Marbled Murrelet Technical Committee (MMTC) met at the 2002 PSG conference in Santa Barbara. Lee Folliard and Doug Bertram brought us up to date on the activities of the US and Canadian Marbled Murrelet Recovery Teams, respectively. Those presentations were followed by a summary by Pat Jodice of progress made on the Effectiveness Monitoring Plan for Marbled Murrelets. Tom Hamer and Danielle Prenzlow outlined the work done over the last year on statistical analyses of the Inland Survey Protocol. Those analyses are examining how many survey visits are re-

quired in order to achieve certain levels of confidence in determining presence and occupancy, and how those visits should be distributed across time. Diane Evans, coordinator of the Inland Survey Protocol Sub-committee, reviewed some lingering issues from the last major rewrite of the protocol (April 2000) and reiterated the timeline for incorporation of the results of the statistical analyses and any other changes into the next revision. We expect to send that document out for external peer review by mid-August.

We discussed other issues related to Marbled Murrelet terrestrial habitat, including tree-climbing as a management tool, disturbance, implementation of existing regulations, and use of aerial photos in management. Kim Nelson presented information related to tree-climbing as a method of approving a stand for harvesting; it was agreed that Kim and others will draft a letter to address concerns. The issue of disturbance was raised at the 2001 MMTC meeting, and a group was formed to review relevant data and suggest guidelines. At the 2002 meeting, Paul Phifer presented a set of options developed by the U.S. Fish and Wildlife Service (USFWS). That agency will decide on their guidelines within days. Given the lack of opportunity for input before the USFWS decision, the MMTC will comment on the guidelines when they are available. Steve Singer presented a request that Marbled Murrelets receive increased consideration in the extension of 10-year plans in the Zone 6 recovery zone, and that laws already on the books be better implemented. Alan Burger would like to discuss the use of aerial photos to delineate good Marbled Murrelet nesting habitat with anyone who has experience in this technique.

The Marine Survey Protocol Sub-committee, coordinated by Sherri Miller, has decided to wait for the results of statistical analyses of marine

COMMITTEE REPORTS

surveys before developing a PSG protocol.

Esther Burkett coordinates both the Research and the Education Subcommittees. She will distribute a list of research priorities for comment. She noted that funds were still insufficient for an educational video.

If you would like further information about any of the activities of the MMTTC, please contact Anne Harfenist at harfenis@bulkley.net.

JAPAN SEABIRD CONSERVATION COMMITTEE: Report on Recent Seabird Work in Japan

John Fries and Koji Ono, Committee
Co-coordinators

[Editor's note: This report includes activities beyond those of the committee, *sensu stricto*. But news about Japan's growing seabird research is welcome, and it is a valuable product of the committee as PSG's liaison with Japan.]

The Japan Seabird Group (formerly the Japan Alcid Society, established autumn 2000) is compiling a Seabird Colony Database, the first of its kind in Japan, with funding from the Ministry of the Environment. An annotated bibliographic database of over 1200 papers has been completed. Staff of the Hokkaido Seabird Center (mail@seabird.go.jp) have read through these papers to retrieve usable information on seabird breeding. This work is finally making clear where gaps exist in past survey efforts, such as the absence of data for the Matsudaira's Storm-Petrel (*Oceanodroma matsudairae*) colony on Kita-Iojimar. The information is now being translated into English, and standard coding is being added. The data will eventually be transferred into the North American database.

A US-Japan symposium on Japanese and North Pacific seabird conser-

vation, scheduled to be held in Hokkaido in conjunction with the official meeting of parties to the US-Japan Migratory Bird Agreement, looks to be held in October. It was originally scheduled for last year, but was yet another collateral victim of the tragedy that occurred on September 11th. The curtailment of official government travel in the US forced its postponement.

A special issue of the *Journal of the Yamashina Institute for Ornithology*, focussing on issues related to the conservation of Japanese seabirds, will be published this year. It will include four papers given at the symposium on this subject held during PSG's annual meeting in Kauai in February 2001.

Regarding the activities of individual researchers in Japan, Dr. Yutaka Watanuki (Hokkaido University, ywata@res.agr.hokudai.ac.jp) continues to be fully engaged in his research on Teuri Island and training students there on seabird research techniques.

Dr. Nariko Oka (Yamashina Institute of Ornithology, oka@yamashina.or.jp) is analyzing stomach contents to look at habitat selection among seaducks. She is also investigating at-sea distribution and foraging habits of Procellariiformes using diving meters and transmitters, preparing to look at correlation of distribution records with marine environmental factors, and is gathering specimens to study exposure of seabirds to toxic substances. She is one of the core members of the satellite-tracking project for the Short-tailed Albatross (*Phoebastria diomedea*) and is working with Fumio Sato (QYR01766@nifty.ne.jp) of the Yamashina Institute's Bird Banding Laboratory. This project is funded by the Ministry of the Environment. Finally, she is also involved with work on a database that will make available 3000 hours of records on seabird distribution in the Pacific.

Dr. Masaoki Takagi (Osaka City University, YRQ01311@nifty.com) is using Australasian Gannets (*Sula serrator*) nesting on artificial structures

in Port Phillip, Australia, to investigate two broad research topics: (1) quantifying the previously neglected factor of energetic cost of incubation as a way to measure the fitness of breeding birds, and (2) trying to explain the asynchronous timing of breeding among this population by taking advantage of the fact that the flat, manmade structures they nest on have no available microhabitats, so colony structure is determined solely by interference from other breeders. Together with his students, he is also investigating lifetime reproductive strategies and cost-benefit of colonial breeding among Black-tailed and Slaty-backed Gulls (*Larus crassirostris* and *L. schistisagus*) on Teuri Island, and is working to explain varying response between these congeners to changes in marine resources in the area.

Yasuhiro Fujita (hujita@kankyosekkei.co.jp) has been documenting at-sea distribution of seabirds along the ferry route between the Oki Islands (southwestern Japan Sea) and the mainland since October 1991, looking at seasonal, spatial, and between-year variation in local seabird communities. He is also comparing data from before and after the 1997 *Nakhodka* oil spill, and he is investigating changes that might be seen since a die-off of Streaked Shearwaters (*Calonectris leucomelas*) in early spring of this year.

Koji and Mihoko Ono have translated a curriculum on seabird conservation provided by the U.S. Fish and Wildlife Service, Office of Migratory Bird Management. The Japanese version will be tailored to focus on local species, and is already being used on an experimental basis in schools in Hokkaido.

Finally, Professor Haruo Ogi of Hokkaido University is tirelessly conducting physiological and ecological research on the Black-tailed Gull population on Rishiri Island. We congratulate Professor Ogi on receiving the Yamashina Yoshimaru Prize last spring for his important contributions to the study of ornithology in Japan. Well deserved!

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ABSTRACTS OF PAPERS AND POSTERS PRESENTED AT THE 29th ANNUAL PACIFIC SEABIRD GROUP MEETING

Santa Barbara Museum of Natural History, Santa Barbara, California
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Abstracts are arranged alphabetically by name of first author. Affiliations are given for all authors; full addresses are given for first authors, private firms and individuals, and some others.

Inter- and intra-decadal variability in the growth rates of Cassin's Auklets: effects of regime shifts and ENSO events

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It is widely accepted that climatic regime shifts transpired in the North Pacific Ocean in the winters of 1976–77 and 1989–90. Preliminary evidence also suggests that a regime shift occurred in the winter 1998–99. Empirical evidence suggests that oceanic productivity (zooplankton abundance and distribution) varies significantly not only between regimes, but also with El Niño–Southern Oscillation (ENSO) events and annual atmospheric changes. The euphausiids *Thysanoessa spinifera* and *Euphausia pacifica* are the principal prey of the Cassin's Auklet during the breeding season at Southeast Farallon Island (SEFI). Additionally, a warm-water euphausiid species, *Nyctiphanes simplex*, is consumed occasionally. Cassin's Auklets on SEFI appear to respond to inter- and intra-decadal variability in oceanic conditions by alternating between these primary prey species. If variable ocean climate results in a change from a more profitable to a less-preferred prey species, there may be corresponding consequences for growth and development of auklet chicks. We examine the growth rates of Cassin's Auklet chicks on SEFI from 1973 to 2001 in relation

to diet and corresponding trends in large-scale atmospheric and oceanographic conditions.

At-sea distribution and central-place foraging of Cassin's Auklets in the California Channel Islands

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We used radio telemetry to study the at-sea distribution of Cassin's Auklets (*Ptychoramphus aleuticus*) nesting in the northern Channel Islands at Prince Island (PI) from 1999 to 2001 and on Scorpion Rock (SR) from 2000 to 2001. Central-place foraging was examined through the movements of 98 adults attending colonies nightly during the breeding season. PI auklets were concentrated north of the colony near the insular shelf break and over the Santa Barbara Basin, and SR auklets frequented the narrow passage adjacent to and along the north side of Santa Cruz Island. We found little overlap in foraging ranges between the two nesting colonies (separated by 60 km). However, there was no difference in mean maximum foraging ranges (35 km) between colonies and years (2000–01). In 2001, PI home ranges increased

3-fold to 3770 km², but maximum foraging ranges were similar to 1999 and 2000. In May–June 2000 and 2001, auklets from both colonies dispersed north of Point Conception coincident with changing oceanographic conditions. Auklet foraging ranges, concentrated at-sea distribution, and locations of breeding colonies were likely linked to persistent prey (euphausiids and larval fish) availability near colonies, due to local oceanographic processes driven by upwelling in the Southern California Bight, and the availability of suitable nesting habitats at colonies. During the colony attendance period, PI and SR auklets are vulnerable to mortality from oil spills in these at-sea foraging areas, whereas during the post-breeding season, they are vulnerable to mortality from oil spills north of Point Conception.

Why murre biologists might want to know more about Adélie Penguins

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One of the most basic of seabird life-history traits, and one that guides interpretation of seabird patterns and management of seabird resources, is the supposed high degree of natal and breeding philopatry exhibited by these creatures. Short-term (within a researcher's life span) data prove this the case. Recent studies, however, have indicated little differentiation over

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broad spatial scales among most seabird species in which genetic work has been accomplished. Therefore, philopatry is called into question. The Adélie Penguin (*Pygoscelis adeliae*) is not exceptional to this conundrum. It is unique, however, in that for large portions of its range, the chronology of colony founding and extinction is known since the end of the Pleistocene (ca 10,000 BP). This is possible from the facts that (1) penguin bones do not degrade in the cold, dry Antarctic climate, and, therefore, (2) glaciologists have used penguin bones found in present and extinct colonies to date the advance and retreat of the Antarctic ice sheets. The history is fascinating and shows that populations, in response to climate change, are far more mobile than heretofore appreciated. I propose that this history is a model for other high-latitude seabird species. See also my web site: www.penguinscience.com.

Occurrence patterns of seabirds in the California Current GLOBEC study area: indicators of top-down influences on food-web structure

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We investigated the occurrence of seabirds in the GLOBEC-Northeast Pacific-California Current study area during a process cruise on 30 May to 13 June 2000. Using flux-adjusted strip transects, we estimated seabird biomass within a fixed grid bounded along the shore from Newport, OR to Crescent City, CA and offshore from the beach to well beyond the shelf break. Water column characteristics were measured nearly simultaneously using

SeaSoar technology. During the cruise, intense upwelling alternated with a downwelling episode, and marked blooms of phytoplankton persisted. In a multiple-regression model, respectably high (for seabirds) 29% of variation in log biomass (all species combined) was essentially explained by 10°C isotherm depth, depth of chlorophyll maximum, and the chlorophyll maximum itself. Among individual species, 57.5% and 31.4% of variation in log biomass for Rhinoceros Auklet (*Cerorhina monocerata*) and Common Murre (*Uria aalge*) respectively, two known predators of juvenile salmon (the GLOBEC target species) was explained by chlorophyll maximum and its depth, plus interactions with other variables. It was not possible (but will be in the future) to include variables related directly to seabird prey. In fact, seabirds did not occur at centers of phytoplankton blooms but at their edges. Seabirds are not vegetarians, but feed on phytoplankton grazers (euphausiids) or their predators (small fish). Therefore, the seabird concentration at the edges of high-biomass blooms, including "holes" within the blooms, may indicate that the spatial extent of blooms is influenced greatly by grazing (top-down control). Alternatively, the grazers are concentrated in more mature portions of blooms temporally "down-stream" from bloom centers (bottom-up control).

Eggshell variation in the American White Pelican

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Eggshell dimensions in the American White Pelican (*Pelecanus erythrorhynchos*) were examined for historical geographic variation based on one of two possible hypotheses: (1) that variation is similar to described geographical population separation (based largely on band returns), or (2) that variation follows one or more environmental gradients in both popula-

tions, the eastern and the western. The null hypothesis would be that there is no detectable geographic variation in egg dimensions anywhere in the historical range. Although the current distribution of White Pelican populations is different from that of historical populations, data in this analysis were all derived from museum specimens to avoid potential new environmental effects on some of the measurements of more recently-collected specimens: those collected before the era of organochlorine insecticides and before recent changes in distribution. Most of the significant variations observed were associated with the size of the egg (length, breadth, volume, and eggshell weight). Smaller eggs were found in southern populations in both the east and west, and populations associated with highly saline lake systems or estuaries ($P < 0.05$). Egg shapes, length/breadth ratios, eggshell thickness, and eggshell thickness indices did not vary significantly anywhere ($P > 0.05$). These findings support a hypothesis that a possible genetic component in geographic egg-size variation is lacking or of only minor importance compared to other factors. Suggested baseline values for comparisons with modern populations over the entire range of the American White Pelican are presented.

Pacific flyway connectivity issues and the importance of the Colorado River Delta region to wintering and migrating American White and Brown Pelicans

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The two North American pelican species, the Brown Pelican (*Pelecanus occidentalis*) and American White Pelican (*P. erythrorhynchos*)

importantly co-occupy the Colorado River Delta Region during significant portions of their annual cycles (the "Delta" includes the Salton Sea and extends into the northern Gulf of California). Here, both species form interspecific feeding and loafing groups, and utilize similar food sources. This is unusual in that the two species seldom overlap ecologically in other parts of their ranges (other than occasional, unusual mixed-species roosting groups or rare mixed-species feeding aggregations). The American White Pelican historically bred in the Delta, but currently a rare, inland colony of the Brown Pelican is the only one of the two to nest, albeit sporadically. Yet the major importance of the region comes during the post-breeding, migration, and wintering stages of both species' annual cycles. American White Pelicans that utilize the Delta are comprised and dominated by individuals from the declining or reduced western population segment, so that events in the Delta will importantly affect the status of White Pelicans in the entire western portions of the continent. The source of Brown Pelicans is from much larger populations in the northern Gulf of California, so that the Delta region supports a smaller proportion of the "global" population. As a case-history of conservation, both North American pelican species abundantly demonstrate what has been shown for other migratory avifauna of the Delta region: that this area is a unique and critical bi-national treasure that represents a vital element in the ecological connectivity of Pacific Flyway for all migratory avian species.

Sixty years of White Pelicans: a GIS analysis of band returns

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A total of 3855 banding records of American White Pelicans (*Pelecanus*

erythrorhynchos) banded between 1922 and 1981 at 43 sites in the U.S. and Canada was analyzed using GIS. Returns showed a clear pattern of two major migratory routes, with birds from California, Oregon and Nevada colonies dispersing south to the Sea of Cortez and the Pacific Coast of Mexico and birds from central Canada, the Dakotas, Colorado, Minnesota, and Montana following the Missouri and Mississippi river drainages to the Gulf Coast, Florida, and Central America. Pelicans banded in Utah and Wyoming were recovered along both routes, with some evidence of a third pathway for these birds along slope of the Rockies. There was little evidence of mixing between the two major migratory populations on the breeding grounds, although there is significant overlap in returns in southern Mexico. Returns from Central America consisted almost exclusively of birds banded in the eastern portion of the breeding range. Survivorship analysis is complicated by differential cohorts and band reporting, but some results can be calculated. Mean time between banding and recovery was 2.7 years (0.059 SE, $n = 3855$), with a maximum age of 37 for a bird banded in Saskatchewan. Of the 1375 birds recovered that had been banded prior to 1960, 39% (535) were recovered within 1 year of banding, and 27% of the survivors were still alive 5 years later.

Prey type and tide stage affect prey delivery rates of Caspian Terns

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We observed 29 Caspian Tern (*Sterna caspia*) nests used by radio-tagged adults at the East Sand Island colony in the Columbia River Estuary. Forage fishes delivered to their young by radio-tagged adults and their mates were visually identified to several dis-

tinct taxa. We sought to determine relationships between time of day, tide stage, prey type, and prey delivery rate. The four most common taxa of forage fish delivered to nests were, in descending order, sardine/herring (Clupeidae), anchovies (Engraulidae), salmonids (*Oncorhynchus* spp.), and smelt (Osmeridae). Sardines/herring and anchovies were delivered to nests at a 61% higher rate (number of fish delivered per hour of observation) than salmonids and smelt. Overall prey delivery rates did not differ with time of day or tide stage, but delivery rates were higher for salmonids during ebb and low tides and for sardine/herring during flood tides. Thus, the availability of particular forage fishes appears to be differentially influenced by tidal fluctuations. Assuming that breeding adults attempt to maximize colony attendance, these data suggest that sardine/herring and anchovies were more available than salmonids and smelt during the 2001 chick-rearing period. Compared to tern diets in previous years, the higher proportions of sardine/herring and anchovies, and lower proportions of salmonids and smelt, appear to reflect major changes in relative availability of these prey types. This suggests there has been a dramatic influx of sardines and anchovies, and perhaps a decline in juvenile salmonids, in the Columbia River Estuary in 2001.

Too close for comfort?: the effects of nesting density on breeding success of Caspian Terns in the mid-Columbia River

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We investigated the breeding biology of Caspian Terns (*Sterna caspia*) nesting on Crescent Island in the mid-Columbia River, near the confluence of the Snake River. The Crescent Island

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tern colony consisted of 720 breeding pairs in 2001 and had an overall nesting density of 1.04 pr/m² (range = 0.25 to 1.48), a high density compared to Caspian Tern colonies in the Columbia River estuary. We conducted a study to test our hypothesis that higher nesting density within the Crescent Island colony would be associated with lower nesting success. We used a total station (Leica TCRA 1105) to obtain spatial data on all existing Caspian Tern nests at hatching. We then used these data to calculate nest characteristics (nearest neighbor distance, density of nests within a 5 m diameter circle, and distance to colony edge) for a randomly-selected subset of nests that were monitored for productivity. Nesting density, nearest neighbor distance, and distance to colony edge were not related to productivity; however, hatch date was strongly negatively correlated with productivity. Overall breeding success at Crescent Island was 0.84 fledglings/pair, high compared to other Columbia River Caspian Tern colonies. We conclude that high nesting densities do not necessarily negatively impact breeding success of Caspian Terns, at least at this range of densities. This information is relevant and potentially useful for planning minimum area requirements of Caspian Tern habitat at managed colony sites.

Relative survival of some hypotheses in seabird biology

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Some ideas from the past are still relevant, others less so. Widespread interest in proximate and ultimate controls of breeding time led to the 1957-59 British Ornithological Union expedition to Ascension Island. Seabirds there proved to show a variety of synchronized and unsynchronized, seasonal and aseasonal breeding schedules, with intervening slow molt. Incubation shifts were mostly long, as were fledging periods. Low reproductive rates in seabirds, claimed by Wynne-

Edwards to result from group selection favoring reproductive restraint as a mechanism to avoid overfishing, were re-interpreted on the basis of David Lack's (Darwinian) concept of selective maximization of reproductive rate. Lack also championed density-dependent regulation of bird populations, especially through winter food competition, but Ashmole argued that in long-lived colony-nesting tropical seabirds, competition for available food was more likely during breeding. Low feeding rates around colonies could favor deferred first breeding, evolution of low clutch-size and prolonged parental care, and also the siblicidal behavior of boobies investigated by Dorward on Ascension. Trophic niche differentiation was also predicted, and for the seabird community of Christmas Island (Pacific) our 1960s study documented it in feeding methods, prey type and prey size. Feeding ranges also appeared to differ, and stomach oil in petrels was interpreted as an adaptation for exploiting distant food sources. Patchiness in prey availability was recognized as a key environmental feature for many seabirds, and convergences as well as upwellings were thought to provide especially rich feeding areas. Environmental variability between years was recognized by 1960 as an important determinant of variation in breeding success, but the widespread impact of ENSO events became clear only subsequently.

A preliminary analysis of the geographic structure of Sooty Shearwater populations from the eastern and western Pacific Ocean using cytochrome *b*

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Global declines of Sooty Shearwater (*Puffinus griseus*) populations have been associated with cli-

matic perturbations, declines in reproductive success, and possible changes in trans-oceanic migration routes. However, a full understanding of these declines requires more information on the geographic structure of shearwater populations, and details concerning specific migration routes. Both of these topics can be addressed using molecular tools. The primary objective of this study is to determine if Sooty Shearwaters nesting along the eastern (Chile/Ecuador) and western (New Zealand/Australia) margins of the Pacific Ocean constitute genetically distinct populations. An additional objective is to develop a molecular marker that would differentiate the two populations, and to use this marker to identify the geographic origin of individuals collected along migratory routes or incidentally taken as fisheries bycatch. We sequenced a 747-base pair fragment from the 5' end of cytochrome *b* in 84 individuals from Chile/Ecuador (30) and New Zealand (54). Preliminary results indicate that there are no fixed mutational differences between the two populations, although haplotype frequencies may differ. These results suggest that the two populations either originated from a single source population or that the populations are exchanging individuals. We are now initiating sequence analyses on the more variable mtDNA control region to help ascertain the degree to which dispersal occurs between these two regions, and to continue to develop a molecular marker that would differentiate the populations.

Disturbance causes and effects and habituation at a colony of California Least Terns

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We observed behavior of Least Terns (*Sterna antillarum browni*) for

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8–12 h per day during the height of their breeding over 2 years. We noted all sources of disturbance and linked them with behavior during a period of heavy disturbance during the ESPN Extreme Sports Games (X-Games) that were held adjacent to the colony, and during the period before and after this event. Terns averaged 10.08 min/h off nests (16.8%) in 1997 and 7.96 min/h of disturbance (13.3%) in 1998. The X-Games had no effect on behavior. The majority of disturbance minutes over the entire time period for both years were from the nest/egg (California Fish and Game) monitors, and from the Animal Damage Control (Wildlife Services) person, both in total duration and in amount of off-nest behavior per visit. Other major behavior changes were from perceived predators on or near the colony. Birds attenuated to all other disturbance events, notably the X-Games. There was no difference in recruitment the years following the X-Games or in reproductive success during the two years of observation.

Adélie Penguin foraging behavior: variation depending on breeding season, colony, and individual

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We report results from studies of foraging behavior of Adélie Penguins (*Pygoscelis adeliae*) provisioning chicks during 2 breeding seasons at 3 colonies on Ross Island, Antarctica. We attached time-depth recorders, with onboard temperature and light sensors, to 79 individuals, recording 62,166 dives: 16% exploratory, 59% foraging, and 25% of other types (mostly traveling). Foraging dive duration averaged 104 s (range 30–235 s) and depth averaged 44 m (range 6–138 m). Colony,

breeding season, 5-day period within breeding season, sex, individual, and light level all significantly affected depth and duration of foraging dives, though individual and breeding season were the most important in explaining variation. Adélie diving depths were largely limited by available light level; only very rarely did they venture into total darkness. Total number of foraging dives, both as a function of frequency (dives/h) and total trip duration, reveal the largest differences among colonies and seasons, with both measures being much higher in one season and at one colony than the other(s). We discuss relationships between these diving variables and sea-ice conditions, diet composition, and chick provisioning. As in a related study, we again caution researchers from drawing conclusions about the foraging of seabirds using small samples of instrumented individuals.

A comparison of variables affecting American White Pelican nesting success at Anaho Island National Wildlife Refuge

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Anaho Island National Wildlife Refuge contains one of the largest nesting colonies of the American White Pelican (*Pelecanus erythrorhynchos*) in western North America. The island is located in Pyramid Lake in northwestern Nevada. The nesting success of pelicans at Anaho Island varies annually, primarily in relation to the availability of food resources in Pyramid Lake and nearby wetland areas in the Lahontan Valley. This poster will critically evaluate different factors believed to affect nesting success. These factors include the size of the spawning runs of Pyramid Lake fishes, including threatened Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) and the endangered cui-ui (*Chasmistes cujus*). Another factor examined in this study is total acreage of Lahontan valley wetlands, located 60 miles south-

east of Anaho Island. The shallow wetlands of the valley offer extensive foraging opportunity for the pelicans in good water years. The purpose of this poster is to compare Pyramid Lake fish spawning run data and Lahontan valley wetland acreage with the Anaho Island American White Pelican breeding population and juvenile survival.

Late versus early Common Murre (*Uria aulge*) chicks: costs and benefits of rapid growth

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While accelerated growth can be advantageous to nestling birds, there may be a tradeoff between rapid growth and resistance to nutritional stress. Common murre (*Uria aulge*) are colonial seabirds that experience higher reproductive success if they synchronize reproduction with neighbors; however, eggs are often laid asynchronously. Parents of late-laid eggs should benefit if they can produce chicks capable of growing quickly and fledging synchronously with their neighbors, but rapid growth might not be without cost. We used captive-hatched murrelets to examine differences in growth between early-hatched chicks and their later-hatched neighbors. We tested potential costs of rapid growth by comparing growth rates of chicks under an *ad libitum* feeding regime with their growth rates under subsequent food restrictions. We found that chicks that hatched later were heavier, ate more and gained body mass more quickly than chicks that hatched earlier. Late-hatched chicks grew quickly enough to reach the same mass as their early-hatched neighbors in five days. However, chicks that grew more quickly under *ad libitum* food conditions grew more slowly when food-restricted. We conclude that parents can produce chicks capable of fledging at the same time and body mass as neighbors but that this potential might only be realized when food

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is not limited. The ability to compensate for late hatching by growing quickly is costly for chicks when food availability is low.

Do birds and mammals of a feather flock together? — species-environment relationships of marine predators in a coastal upwelling system

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Management of human impacts on marine ecosystems requires an understanding of both anthropogenic effects and natural patterns of variability. Traditionally, single-species approaches have been employed to identify critical habitat for particular species of interest. Increasingly, however, it is becoming apparent that successful management will require multi-species approaches towards identifying important marine habitats. We report on ecosystem studies conducted in a coastal upwelling region, Monterey Bay, California. Monthly random-systematic transect surveys were conducted between May and November of 1996 to 1999. The objective of the study was to determine the distribution and relative abundance of marine mammals, seabirds, and krill with respect to physical variables, including depth, depth gradient, surface temperature, and mixed layer depth. Canonical Correspondence Analysis (CCA), a unimodal ordination technique, was used to identify relevant patterns of species association and habitat partitioning for the most common species. The first two canonical axes cumulatively explained 85% of the variation in species-environment patterns. Axis 1 strongly correlated with bathymetric depth and slope. Axis 2 correlated with mixed layer depth and Julian date. Marine birds and mammals negatively associated with Axis 1 represented species known to

forage on krill or krill predators, such as squid. Species positively associated with Axis 1 were primarily piscivorous. Axis 2 separated late-season migrants, associated with a deeper mixed layer, from an assemblage of species associated with early-season upwelling. Multidisciplinary surveys and CCA appear to be an effective means of describing associations of upper trophic level predators and their habitats in a highly variable coastal upwelling system.

Contrasting adult survival of Cassin's Auklet on colonies in different oceanographic domains within British Columbia

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We report on the survival of resident adult Cassin's Auklets (*Ptychoramphus aleuticus*) from two breeding colonies in British Columbia: Triangle Island, influenced by the California Current ecosystem, and Frederick Island, influenced by the Alaska Current ecosystem. We captured and banded birds at both colonies from 1994 to 2000 and analyzed the recovery data with Program MARK. Local adult annual survival was significantly lower on Triangle Island (~0.42–0.80) than on Frederick Island (~0.82–0.93, except 1997–1998). In 1998, the year of a large-scale ENSO event, significantly fewer birds were breeding on both islands than in previous years. Adult survival was also markedly lower from 1997 to 1998 (0.54–0.61) than in other years for Frederick Island, though both islands experienced depressed survival from 1997 to 1998. Our results are consistent with the hypothesis that ocean climate during the 1990s was generally a greater survival challenge for Cassin's Auklets breeding on Triangle Island (California Current ecosystem) than for those breeding on

Frederick Island (Alaska Current ecosystem). However, the 1997–1998 ENSO event was particularly stressful for the Frederick Island birds. We offer explanations for our observed differences in adult survival in the context of the availability of zooplankton prey, and also of reproductive performance and nestling diet collected concurrently on both colonies.

Clearing the air: using radar to refine marbled Murrelet habitat use patterns

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A key conservation objective of The Pacific Lumber Company Habitat Conservation Plan is to understand patterns of inland habitat use by Marbled Murrelets. In California, Marbled Murrelet (*Brachyramphus marmoratus*) habitat relationships are primarily based on information from Pacific Seabird Group (PSG) protocol surveys. However, using PSG protocol data to evaluate the conservation importance of lands set aside for Marbled Murrelets remains controversial. Recent studies have found that radar is an extremely effective tool for detecting murrelets. In Humboldt County California, we conducted simultaneous radar and audio-visual surveys across a wide range of habitats and environmental conditions. In the 2001 breeding season, 30 audio-visual survey stations were simultaneously surveyed four times by radar and audio-visual surveyors. We quantified the likelihood of an audio-visual surveyor detecting the same murrelets tracked by radar. We also explored the relationship between environmental and habitat factors associated with audio-visual surveyors detecting radar tracked murrelets. At best, audio-visual surveyors detected less than 20% of the murrelets tracked by radar and were

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less likely to detect murrelets in closed canopy areas. Finally, we discuss how this information may refine our understanding of Marbled Murrelet behavior and habitat relationships.

The effect of investigator disturbance on the reproductive success of a long-lived seabird

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Long-lived birds are expected to invest little in each reproductive event and therefore to abandon a breeding attempt when conditions become unfavorable, such as under investigator disturbance. I tested whether the frequency and timing of investigator disturbance influenced Leach's Storm-Petrels' (*Oceanodroma leucorhoa*) hatching success (HS), and whether the effects of disturbance persisted one year later. HS was affected by the frequency of disturbance: 39% of 18 eggs belonging to pairs receiving daily disturbance (FREQUENT) and 45% of 20 eggs belonging to pairs receiving weekly disturbance (MODERATE) hatched, whereas 95% of 20 eggs belonging to CONTROLS hatched. Most (91%, $n = 23$) failures were caused by egg desertion. I predicted that pairs disturbed in the EVENING would have lower HS than pairs disturbed in the MORNING, since birds disturbed in the morning must wait until night to leave, at which time they might no longer be motivated to terminate incubation. However, the time of day of disturbance did not affect HS (MORNING: 57%, EVENING: 65% overall). The effect of disturbance on HS did not persist one year later (FREQUENT: 92%; MODERATE: 100%; CONTROL: 89%). That year, 78% of FREQUENT, 55% of MODERATE, and 90% of CONTROL burrows were active, suggesting that disturbance caused pairs to relocate. Since most changes in nest-site also result in a mate change, disturbance that causes birds to desert their burrows

may be costly. Overall, these results indicate that long-lived birds are sensitive to disturbance during incubation and that studies requiring >2-3 visits/season will cause high rates of egg desertion.

Pelagic foraging areas of Cassin's Auklets breeding on Triangle Island, 1999-2001

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We describe the at-sea distributions of Cassin's Auklets, a seabird that breeds on Triangle Island, BC, and forages on zooplankton in pelagic waters during the day. Our results may be used by managers to design an effective Marine Protected Area (MPA) for the Scott Island group. Triangle Island supports the largest population of Cassin's Auklets in the world, estimated at over 500,000 pairs. Radio-transmitters were attached to Cassin's Auklets that were rearing chicks. Between 35 and 40 transmitters were attached to adult birds in late May or early June in each of 3 years, from 1999 to 2001. Telemetry flights were conducted to locate these marked birds using high altitude (3000 m) grids. Over 90% of the birds confirmed to be attending the colony were detected at sea each year. In 1999 and 2000, most marked birds were located 30-75 km southwest of Triangle Island in waters 1500-2000 m deep. In 2001, however, most marked birds were located 60-90 km northwest of Triangle Island in waters >1500 m deep. This distribution shift in 2001 likely reflects a change in the distribution of Cassin's preferred prey.

Once an Alcid, always an Alcid: the effects of timing of breeding, foraging location, and terrestrial habitat use on reproductive success in radio-marked Marbled Murrelets

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I describe the effects of behavioral and habitat variables on annual reproductive success in radio-marked Marbled Murrelets (*Brachyramphus marmoratus*) from Desolation Sound, British Columbia from 1998 to 2001. Correlation analyses showed that earlier-breeding birds tended to travel further from foraging areas to nesting areas, and nest at sites that had steeper slopes than later-breeding birds. Nest site elevation was not correlated with any other variables, except nest site slope in one year. In univariate logistic regression, timing of breeding, commuting distance, nest site slope, and nest site elevation were all significant predictors of reproductive success. Relationships between these predictors and breeding success were all positive, except timing of breeding. There were no significant effects of year on these relationships. Multivariate analyses were unsuccessful in discriminating the relative importance of each variable, but there were no significant interaction effects. I also examined the effects of close proximity to forest edge on murrelet reproductive success. Despite the high level of logging in our study site, most nest sites of radio-marked birds were located adjacent to natural edges. In "small scale" analyses of ground-accessible nests with known fledging success ($n = 37$), no significant differences in nesting success were detected between nests in edge and interior conditions. Large scale GIS analyses ($n = 98$) showed nests within 200 m of a natural forest edge had higher success than those found in interior conditions. I discuss our results in terms of Alcid life history theory.

A comparative analysis of seabird wing shape using traditional morphometrics and relative warp analysis

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Wing morphology of nine species of seabirds from Johnston Atoll in the central tropical Pacific was analyzed to determine how wing size and shape correlated with observed foraging behavior. Red-tailed Tropicbirds (*Phaethon rubricauda*) and Christmas Shearwaters (*Puffinus nativitatis*) had lower wing areas, shorter wing spans, and higher relative wing loading than would be predicted from mass alone. Brown Noddies (*Anous stolidus*) and Red-footed Boobies (*Sula sula*) had lower wing loading, Brown Boobies (*Sula leucogaster*) and Sooty Terns (*Sterna fuscata*) had higher aspect ratios, and Brown Noddies had lower aspect ratio than would be predicted from mass alone. In most cases, predicted differences in wing morphology correlated well with observed foraging differences among species, and species that did not differ significantly in body mass differed with respect to wing size and shape. Using a different method, the wing shape of Brown, Red-footed, and Masked Boobies (*Sula dactylatra*), as well as the Red-tailed Tropicbird, was analyzed by recording landmark coordinates from the wing tracings. These coordinates were then used to model wings as thin-plate splines (TPS), and TPS relative warp analysis was performed to compare wing shape among the four species. Red-tailed Tropicbirds, Brown, and Masked Boobies are typically plunge divers, whereas Red-footed Boobies typically practice aerial pursuit of flying fishes. Although the tropicbirds (family Phaethontidae) are similar in their diving behavior to the Brown and Masked Boobies (family Sulidae), their wing shape was most distinct, suggesting a phylogenetic signal. This method provides an alternative view of wing shape compared with traditional morphometrics.

Coevolution or coincidence: host specificity and microhabitat selection in the analgoid feather mites of Caspian Terns

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Symbiotic feather mites are found on virtually all bird species, yet there is considerable confusion regarding their ecological roles. Are they parasites, commensalists, or mutualists? Is each species of mite adapted to a particular bird species, or do they have a number of potential host species? I studied a species of analgoid feather mite living on the primary feathers of Caspian Terns (*Sterna caspia*) using two approaches. First, I quantified mite loads on birds collected throughout a breeding season to compare levels of mite infestation with host condition and to document the spatial distribution of mites among the primaries. Second, I tested the extent of host specificity by imping (transplanting) California Gull (*Larus californicus*) feathers onto the wings of Caspian Terns and examining the mites' capacity to colonize gull feathers. Although mite loads varied greatly, they showed no relationship with host body condition, date, or sex. Mites were most abundant among the more distal portions of the outer primaries, which is contrary to what one would predict based on aerodynamic considerations. Mites "incubated" on tern wings showed no preference for feather type, and further experiments showed no response to treatments involving different preen oils. My results show little evidence for a coevolutionary "arms race" and, therefore, imply that feather mites are commensal or perhaps mutualistic. The observed colonization of gull feathers suggests that some mite species have the potential to occupy a number of host species by selecting different microhabitats, although opportunities for host switching in nature may be rare.

Use of the Vandenberg "no take" marine reserve by foraging Brandt's and Pelagic Cormorants

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As indicators of marine environments, seabirds can be useful in assessing the effectiveness of "no take" marine reserves. During the 2000 and 2001 breeding seasons, we studied the nearshore foraging activities of Brandt's Cormorants (*Phalacrocorax penicillatus*) and Pelagic Cormorants (*P. pelagicus*) at four study plots along the coastal margin of Vandenberg Air Force Base in California. Two of our plots were located on the leeward side of a major promontory, while the other two on the windward side. For each pair of windward and leeward plots, one plot was located inside the marine reserve and the other outside. For both cormorant species, there were significantly more birds foraging in plots outside the marine reserve than inside. This was true during both years. The foraging activity outside the reserve was mostly due to high use of the southernmost plot (a leeward plot) in our study area. In fact, both leeward plots were used significantly more than windward plots. We present two possible explanations. First, the two cormorant species may prefer to forage in waters with calmer surface conditions. Second, and most probable, there may be a greater abundance of prey in protected waters. These results suggest that nearshore marine reserves designed to protect the foraging opportunities of seabirds should be located on the leeward side of coastal promontories in the California upwelling system.

Density and spacing of Marbled Murrelets in forest nesting habitat: evidence of territoriality?

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Studies using radar to count Marbled Murrelets (*Brachyramphus marmoratus*) in British Columbia and Washington show significant linear relationships between numbers of murrelets per watershed and areas of old-growth forest within these watersheds. This pattern indicates a relatively constant density of birds per hectare of available habitat within each study area. Three studies from different parts of BC gave relatively similar densities when considering all available old-growth (range among studies 0.033–0.042 birds per ha), or sub-sets of more optimal forest habitat (range 0.057–0.083 birds per ha). These densities include both breeding and non-breeding birds, which cannot be separated using radar. The radar data show that murrelets breed at low densities per area of available forest (confirmed by tree-climbing studies), and suggest that there might be mechanisms ensuring spacing of nests. We review the behavior of murrelets flying over forests for evidence of territoriality or spacing behavior. The nature, frequency, and timing of certain behaviors and vocalizations are consistent with spacing behavior, although overt agonistic encounters are rare. Infrequent re-use of nest-sites argues against defense of specific nest platforms, but there might be defense of larger areas containing many suitable platforms. Spacing behavior might have evolved if widely spaced nests experienced lower predation. Spacing behavior also has important management implications. Patches of forest in fragmented landscapes might support fewer breeding pairs than expected if the birds maintain widely spaced nests or defend large areas around nest sites.

Battling invasive species at seabird colonies: a war worth winning

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Seabirds are particularly susceptible to devastating impacts caused by introduced predators that eat adults, chicks, and eggs, and ungulates that trample burrows and nests. It is technologically feasible to remove many invasive species, but such actions can be politically complicated. Over the past 50 years, the staff at Alaska Maritime National Wildlife Refuge has removed introduced foxes (*Alopex lagopus* and *Vulpes vulpes*) from 39 islands totaling 480,000 ha. Feral livestock (cattle and reindeer) has been removed from 4 islands totaling nearly 40,000 ha. Within the past 10 years, we have instituted programs to prevent additional rat (*Rattus* spp.) introductions and have begun evaluating rat removal from some of the smaller refuge islands. Furthermore, we are beginning a program to remove introduced ground squirrels (*Spermophilus undulatus*). Bird recovery has been dramatic. For example, we estimate that breeding populations of seabirds, particularly those nesting on the surface and in earthen burrows, have increased by more than 100,000 following fox removals. Populations should continue to increase for several decades. Fox removal has also been the principal reason for recovery of the formerly endangered Aleutian Canada goose (*Branta canadensis leucopareia*). Invasive species removal initially can be expensive and controversial, but the return will likely be dramatic and lasting. It is a war worth winning, whatever it takes.

Brown Pelican roosting patterns in June–October 2001 at Mugu Lagoon, California

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Daily and seasonal patterns of roost attendance by Brown Pelicans (*Pelecanus occidentalis*) were examined at Mugu Lagoon, California, from June to October 2001. Roost attendance typically increased shortly after sunrise and decreased at sunset. Numbers of roosting pelicans were similar between days in June, increased in July, peaked in August, and declined during September and October (range of monthly high counts: 89–572). Brown Pelicans roosted overnight through August, with some nocturnal movements due to disturbance and high tides, but ceased night roosting in September. Daytime disturbance events occurred sporadically due to aircraft and raptors. Monthly aerial photographic surveys within 60 km of Mugu Lagoon in 2000 showed different patterns of seasonal attendance at other major roosts. Seasonal aerial photographic surveys of all pelican roosts in the Southern California Bight were conducted in 1999–2001 and indicate that Mugu Lagoon continues to be the largest estuarine roost in the bight.

Oil spills and seabird mortality in California, 1969–1999

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We summarize available information on species composition and numbers of seabirds recovered on shore and the total estimated mortality during 45 oil spills in California between 1969 and 1999. After the 1969 Santa Barbara and 1971 San Francisco oil spills, organized efforts by private groups to document seabird oiling through beached bird surveys and to rehabilitate oiled seabirds grew considerably. Large-scale efforts to enumerate numbers of oiled seabirds on shorelines and effective techniques to estimate total mortality were first developed by private groups, with limited agency support, during the 1984 *Puerto Rican* and 1986 *Apex Houston* oil spills. During the 1990 *American Trader* oil spill, agencies first led efforts to document seabird mortality. In the 1990s, state and federal agencies developed large-scale programs, in cooperation with private groups and universities, to ensure detailed documentation of seabird mortality as a key component of obtaining settlements from responsible parties for restoration of affected natural resources. In the 1997 *Kure* oil spill, the most complete documentation of seabird mortality to date was obtained. Seabirds often recovered in large numbers include: Common, Pacific, and Red-throated loons (*Gavia immer*, *G. pacifica*, *G. stellata*); Western, Clark's, Horned, Red-necked, and Eared grebes (*Aechmophorus occidens*, *A. clarkii*, *Podiceps auritus*, *P. grisegena*, *P. nigricollis*); Brown Pelican (*Pelecanus occidentalis*); Double-crested Cormorant (*Phalacrocorax auritus*); White-winged and Surf scoters (*Melanitta fusca* and *M. perspicillata*); Common Murre (*Uria aalge*); Cassin's Auklet (*Ptychoramphus aleuticus*); and Rhinoceros Auklet (*Cerorhinca monocerata*).

The 1986 *Apex Houston* oil spill in central California: seabird mortality, injury assessment, litigation, and restoration planning

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We describe over a decade of biological, legal, and agency efforts to address impacts to seabirds from the 1986 *Apex Houston* oil spill in central California. This relatively small spill (616+ barrels) was conservatively estimated to have killed about 9900 seabirds, including 6300 Common Murres (*Uria aalge*). Direct mortality was reasonably well documented by private groups, using beached bird surveys, at-sea surveys, and oil trajectory modeling. Adequate knowledge of the biology and status of local breeding populations allowed identification of potential long-term impacts on relatively small, depleted, and declining local populations of murres and Marbled Murrelets (*Brachyramphus marmoratus*). This incident demonstrated that small oil spills can have serious impacts to seabirds and that injury, not just the amount of oil, must be measured before judging appropriate damages. During lengthy litigation, federal and state governments scrutinized available biological information, refined direct mortality and population injury determinations, and proposed specific restoration plans. A \$6,400,000 settlement was reached in 1994. After additional restoration plan-

ning, most funds were assigned to two restoration projects in central California, which were administered by federal and state trustee agencies. (1) Recolonization of extirpated murre colonies using "social attraction" techniques began in 1996, especially at Devil's Slide Rock, where the colony probably was extirpated by this spill after reduction from gill-net mortality; (2) Privately-owned residual old-growth forest nesting habitat was purchased for murrelets in the Gazos Creek Watershed in 1998.

Murres held hostage: do decoys prevent flushing of Common Murres?

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As part of an ongoing restoration project for Common Murre (*Uria aalge*) colonies in central California, we examined murre flight response to disturbance from nearby aircraft and boats during the breeding season from 1997 through 2001 at Devil's Slide Rock (DSR), Castle/Hurricane Colony Complex (CHCC), and Point Reyes Colony Complex (PRCC). Despite greater numbers of fly-overs at lower altitudes at DSR, murres flushed less frequently at DSR and more frequently at CHCC during helicopter fly-overs ($\chi^2 = 56.11$, $p < 0.01$). A similar pattern was found for aircraft fly-overs ($\chi^2 = 7.24$, $P < 0.05$). Murres on DSR may exhibit less flight response to aircraft disturbance due to: (1) the presence of the immobile decoys and recorded murre colony sounds (used as social attractants) that may reduce the tendency for murres to take flight during a potential disturbance; (2) murres on DSR may be more habituated to aircraft and associated noise because of the close proximity of the Half Moon

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Bay airport; (3) the presence of breeding Brandt's Cormorants (*Phalacrocorax penicillatus*), which may be less apt to take flight during a potential disturbance.

Improving the conservation status of the world's seabirds through the Bonn Convention on Migratory Species

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The seabirds of the world are linked by one sea. Many have ranges that are unrestricted by national boundaries, and few are endemic to a single country. Most undertake regular migrations or practice juvenile dispersal across international borders and into international waters. The United Nations-based global Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention or CMS) came into force in 1979 to improve the conservation status and management (including sustainable use) of migratory species, including but not restricted to birds, through collaborative actions by states within the ranges of species. The CMS works mainly as a framework convention, encouraging its parties to adopt Agreements, Memoranda of Understanding (MOUs) and/or Action Plans for species or groups of species that have previously been listed in its appendices. Such Agreements and MOUs are stand-alone instruments that may be ratified by range states that are not parties to the CMS, thus offering considerable opportunity and flexibility for regional

actions. The CMS has 76 parties (as of 1 November 2001) on all inhabited continents, although some countries are conspicuous by their absence, including several that border the North Pacific Ocean. Currently, 47 of the 350-odd species of seabirds (Orders Sphenisciformes, Procellariiformes, and Pelecaniformes, families Laridae, Stercorariidae, Sternidae and Alcidae) are listed in CMS Appendices, notably including all the world's albatrosses. The CMS will hold its 7th Conference of Parties in September 2002 when South Africa intend to nominate a further 12 seabird species to Appendix II, which lists migratory species for which Agreements (including MOUs) would improve their conservation status. Two Agreements that include seabirds have been developed to date. The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) came into force in 1999. It includes, *inter alia*, 26 seabird species, mostly gulls and terns. It currently has 34 Parties and aims to improve the conservation status of 172 migratory waterbird species (mainly anatids and charadriiform shorebirds) that utilize the flyways between Eurasia and Africa. The Agreement on the Conservation of Albatrosses and Petrels (ACAP) was negotiated at meetings in Australia and South Africa in 2000 to 2001, and will come into force once five countries have ratified it, which is expected to happen during 2002. It covers 21 species of albatrosses (new taxonomy) and seven large petrels, and aims to provide an integrated and holistic approach to albatross and petrel conservation which will enhance coordination and harmonization of conservation actions, both on land and at sea. Because ACAP is not geographically restricted in scope, it can in the future be expanded to cover all the world's albatrosses by the simple addition of the three Northern Hemisphere species to its annex, without need for renegotiation. South Africa is working towards proposing a MOU for southern African breeding seabirds (15 species), in order to improve their conservation status through collaborative actions by their

breeding range states. Opportunities exist for further Agreements and MOUs to be negotiated under the CMS that can work towards conserving seabirds elsewhere in the world. Examples include the guano seabirds of the Humboldt Current along the Pacific coast of South America, the large number of alcid species of the North Pacific, the seabirds of the Mediterranean, and the tropical seabirds of Small Island Developing States (SIDS) of the Atlantic, Indian, and Pacific Oceans. For all these existing and proposed instruments, the aim is that countries with similar suites of seabird species and conservation problems share knowledge, expertise, and resources in a cooperative way. Such regional cooperation for seabird conservation can be greatly facilitated by marine ornithologists who are willing to use their experience and enthusiasm to motivate national governments to become parties to the CMS, nominate seabird species to its appendices, and work towards the adoption of new "daughter" instruments under its aegis.

Field guide to fish identification for Caspian Tern diet studies in the Columbia River estuary

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We present a fish identification guide based on field characteristics of fish that were caught and carried in the bills of Caspian Terns (*Sterna caspia*) during the 2001 breeding seasons on East Sand Island in the Columbia River estuary. This guide includes images of over 20 fish species in the bills of terns. The guide describes fish behavior, body rigidity, colors, textures, sizes, and anatomical changes based on over 4000 observations. Other data recorded included adult handling time, number and age of chicks, chick feeding behaviors, and the fish's fate. We also measured aggression, piracy, and klepto-

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parasitism between chicks within and among broods, chicks and adults, and gulls and terns. We anticipated that larger fish were more likely involved in kleptoparasitism, piracy, and chick fights. The diet was primarily anchovies, (Engraulidae) (39.5%), herring, shad, sardines, (Clupeidae) (18.0%), perches (Embiotocidae) (14.4%), and salmon (Salmonidae) (10.9%). The size of fishes ranged from 5 to 26 cm with a mean size of 13.6 ± 2.9 cm ($n = 2719$). Chick feeds that encountered hostility, (i.e., attempts of kleptoparasitism, piracy, or fish fights), were significantly larger than the mean size of all chick feeds (14.91 ± 2.8 cm, $P < 0.05$). There was also significantly less hostility with fishes 15 cm and less, and significantly more hostility with fishes larger than 16 cm ($P < 0.05$). There was a significant positive correlation between chick age and the mean size of fish ($r = 0.80$, $P < 0.05$). These results support our hypotheses that larger fish are more often the subjects of kleptoparasitism or agonistic behavior among Caspian Terns.

Using Radar to Monitor Populations and Assess Habitat Associations of Marbled Murrelets within the Sunshine Coast Forest District

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I used radar to count numbers of Marbled Murrelets (*Brachyramphus marmoratus*) flying into 27 watersheds within the Sunshine Coast Forest District (SCFD), British Columbia, in 2000 and 2001. My goals were (1) to document the size and distribution of the Marbled Murrelet population within watersheds of the district, and (2) to investigate habitat associations of this population at the watershed scale.

In the two years of survey, the maximum predawn counts ranged from 7 Marbled Murrelets at Rainy River to 435 at Toba River. The highest numbers of Marbled Murrelets were detected at Toba River, Brem River,

Forbes River and Quatam River. The lowest counts were at watersheds associated with Howe Sound and Sechelt Inlet. At eleven watersheds, more than 100 Marbled Murrelets entered during dawn surveys, and these sites accounted for more than 80% of the total count. These radar surveys have established, for the first time, the presence of Marbled Murrelets in the more remote regions of the SCFD, such as those along Bute Inlet. Radar counts provide a baseline estimate for future assessments of whether or not forest development and species recovery plans are meeting the required objectives.

The area of habitats within 21 watersheds, which were categorized by Biogeoclimatic (BEC) zones, elevation, and forest age, was derived from the overlay of 6 digital GIS databases. Radar counts at these watersheds most strongly correlated to the amount of Old Forest (>250 yr) in both High (>650 m) and Low (<650 m) BEC zones. After controlling for the total area of the watersheds, counts were also negatively correlated to the area of Alpine Tundra and Mature forest (140–250 yrs). In comparison to other radar studies in BC, the SCFD radar counts were more strongly correlated to higher elevation BEC zones, rather than lower elevation BEC zones. This is likely a response to the relative paucity of habitat at low elevations within the SCFD.

Marbled Murrelets appear to nest at much lower densities (birds/ha) in the SCFD than in other areas in BC. Densities of Marbled Murrelets within specific watersheds did not increase with greater percentages of immature and recently logged habitat, or in relation to the amount of habitat originally available before industrial timber extraction. This concurs with other studies that propose Marbled Murrelets do not pack into areas at higher densities when nesting habitat is removed.

Seabird identification verification techniques in the North Pacific Groundfish Observer Program

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The North Pacific Groundfish Observer Program was implemented in early 1990. Potential observers must possess a four-year degree from an accredited institution in the natural sciences or related field. Candidates attend an intensive three-week training course at either the Alaska Fisheries Science Center in Seattle or the Observer Training Center in Anchorage. The course covers all aspects of observer sampling methodologies, responsibilities, and priorities and includes fish, crab, seabird, and marine mammal identification training. The seabird component of the training incorporates an audiovisual presentation and hands-on identification of study skins with the aid of a dichotomous key. Upon successful completion of the course, observers are placed on commercial fishing vessels in the Bering Sea and Gulf of Alaska. Observers collect a variety of catch effort and biological data for a host of end users to meet a suite of management objectives. The seabird component of observer responsibilities has increased since the inception of the observer program. Observers collect data on the incidental take of seabirds, as well as documenting interactions and recording sightings of species of interest. To ensure the quality of the data being collected, three techniques are being used or are in the process of being implemented. Observers on longline vessels are collecting seabird specimens for demographic studies and these specimens also provide species identification verification. New observers will be provided with disposable cameras with instructions to take photos of each species of seabird incidentally caught during their deployment. And a seabird identification form is being developed for use in the field to record the key characteristics of each species of incidentally caught seabird.

ABSTRACTS

Proximate factors determining fledging mass and age in Rhinoceros Auklets

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Food acquisition at the nest and expectation of post-fledging survival, which will be functions of growth rate and fledging date, are hypothesized to be ultimate factors determining fledging mass and age. Many studies of alcid have shown that faster-growing chicks fledged younger and heavier and earlier-hatched chicks fledged older and heavier, which should result in a negative and a positive relationship between fledging age and mass, respectively. How growth rate and hatching date determine fledging age and mass in large-year food variability has been uncertain. The effects of growth of wings and synchronization of fledging, which may be critical for post-fledging survival, are also unclear. We studied the effects of chick growth rate and hatching date on fledging age and mass in Rhinoceros Auklet (*Cerorhinca monocerata*) at Teuri Island in 1995–2000. Although there was no significant relationship between fledging age and mass in most of the years, the results of multiple-linear regression analysis indicated faster-growing chicks fledged younger and heavier and earlier-hatched chicks fledged older and heavier in every year. The mass growth rate did not affect the wing length at fledging, and most of the chicks fledged with similar wing length in every year. Later-hatched chicks showed the possibility of large mass recession, but chicks did not synchronize timing of fledging except in 1995, possibly because parents laying later might stop food provisioning at younger chick age but their chicks did not leave the nests soon. Therefore, growth rate and hatching date were certainly proximate factors

determining fledging mass and age, and chicks may optimize resource allocation under a constraint of food acquisition.

Spatio-temporal variation of seabird bycatch in Alaska longline fisheries

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Incidental take (or bycatch) of seabirds in longline fisheries has been linked to the decline of several seabird populations worldwide. In Alaskan waters, more than 2,000 vessels in demersal longline fisheries set over 200 million hooks each year. Management efforts to reduce bycatch are driven by concern for all North Pacific albatrosses, especially the endangered Short-tailed Albatross (*Phoebastria albatrus*). However, the observed bycatch is dominated by Northern Fulmars (*Fulmarus glacialis*; 60–75%), followed by gulls (*Larus* spp.; 14–18%), albatrosses (*Phoebastria* spp.; 3–10%), and shearwaters (*Puffinus* spp.; 2–6%). Bycatch rates have been characterized on a gross (large marine ecosystem) scale, but smaller scale patterns remain unexplored. Using data from the NMFS Groundfish Observer Program, we contrast 1995–2000 bycatch rates for the Gulf of Alaska and Bering Sea fisheries by seabird taxa (5), geographic region (>10), vessel type (2), target fish species (5), and season (>10). Although bycatch rates fluctuate widely in time, trends persist. Catcher-processing vessels, which process fish on board, have consistently higher bycatch rates than catcher vessels, which deliver fish to land-based processors, regardless of fish species targeted. In the Pacific cod (*Gadus macrocephalus*) fishery, fulmars are the dominant bycatch. Albatrosses are a relatively minor component of the catch by the Pacific cod fishery, whereas in the halibut

(*Hippoglossus stenolepis*) and sablefish (*Anoplopoma fimbria*) fisheries, albatrosses make up a much larger percent. Differences in seabird bycatch rates between vessel types and between target species may be driven by seabird species-specific geographic variation, including proximity to colony, environmental and oceanographic conditions, and migration routes. A comprehensive understanding of the spatial and temporal dynamics impacting seabird bycatch is necessary for fisheries managers, as well as seabird biologists, to more accurately estimate total bycatch and to make informed choices when evaluating tools to reduce seabird bycatch.

The effects of a phase shift in the Arctic Oscillation on Black Guillemots in the western Arctic

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The Arctic Oscillation (AO) refers to a pattern of fluctuation in atmospheric pressure at polar and middle latitudes. In its negative phase, higher than normal sea level pressure over the polar regions acts to prevent the northward movement of lower-latitude weather systems, resulting in cooler conditions. In the positive phase, lower pressure at the pole results in warmer temperatures. A shift in the AO from the negative to the positive phase in the late 1980s coincides with a number of changes in the population size and breeding chronology of Black Guillemots (*Cepphus grylle*) in northern Alaska. The largest breeding colony in Alaska declined from 225 pairs in 1989 to <125 pairs by the end of the 1990s. This decline may be related to documented decreases in the extent and thickness of sea ice over the same period. Guillemots forage in and next to the pack ice throughout the year. Changes in spring snowmelt related to the shift in the AO resulted in a step-wise advancement of clutch initiation, as nest sites became snow-free earlier.

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These effects demonstrate the conflicting effects of regional warming; for guillemots in the arctic, reduced sea ice may be causing a decline in prey availability while an increased snow-free period decreases temporal constraints on breeding.

Sexual dimorphism in culmen length as a tool to determine the sex of individual American White Pelicans

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Culmen length is potentially diagnostic for sex in American White Pelicans (*Pelecanus erythrorhynchos*). However, the literature on the use of culmen length to determine sex is inconsistent, with a reported overlap in culmen lengths for males and females ranging from 1 mm to >120 mm. We took morphological measurements on a sample of 186 pelicans collected in Mississippi and Louisiana whose sex was determined by dissection and gonadal inspection. We developed a multivariate discriminant function model to determine sex from our data and compared the diagnostic accuracy of the model with the accuracy based on culmen length alone. Culmen length and wing chord length were significant variables in the resulting discriminant function model. The model was validated using both cross-validation and an independent sample of 22 pelicans collected in Florida. The resulting model correctly classified sex of pelicans 97% of the time using cross-validation and 94% of the time for the independently collected FL sample. A culmen length of ≥ 310 mm for males

and ≤ 309 mm for females correctly classified sex for 98% of pelicans for the MS and LA sample and 94% of pelicans for the FL sample. Therefore culmen length alone provides an accurate, simple, and non-lethal method for sex-determination in the American White Pelican.

Aggressive competition among brood mates

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Violent aggression between young brood mates has been discovered in diverse avian species including the Brown Pelican (*Pelecanus occidentalis*) several boobies (*Sula* spp), the Black-legged Kittiwake (*Rissa tridactyla*), and the Black Guillemot (*Cephus grylle*). Chicks sometimes kill each other by expulsion from the nest or exclusion from parental feeding, but it is also common for brood mates to coexist all the way through fledging, but showing a marked dominance hierarchy in which distinct agonistic roles are adopted by different brood members. To understand the nature and the evolution of this agonism, my colleagues and I have analyzed the control, development and function of both aggressiveness and submissiveness in chicks of the Blue-footed Booby (*S. nebulosus*). This talk will review our findings from descriptive and experimental field studies and try to offer additional insights by contrasting the behavioral ecology of the facultatively siblicidal Blue-footed Booby and the obligately siblicidal Brown Booby (*S. leucogaster*).

Breeding status of the California Least Tern at Alameda Point, Alameda, California, 2001

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The California Least Tern (*Sterna antillarum browni*) has been on federal and state endangered species lists since 1970 and 1971, respectively. The northernmost breeding location of this subspecies is on the former Naval Air Station, Alameda, in San Francisco Bay; since the Air Station's closure in 1997, the area is now referred to as Alameda Point. Alameda Point has hosted the largest California Least Tern colony in northern California since 1977. Through contracts with the U.S. Navy and U.S. Fish and Wildlife Service, the colony has been managed and protected by the Golden Gate Audubon Society (1979–1999) and PRBO (2000–2001). Data on reproductive success, predation, disturbance, nest distribution, and dropped prey composition have been collected. There were 275 total nesting attempts in 2001, slightly down from the 312 attempts in 2000. The estimated 265 breeding pairs in 2001 is also a decrease from the 280 pairs observed in 2000. The estimated 320 fledglings produced by the colony in 2001 was a marked increase from the approximately 200 fledglings in 2000. Of all the eggs laid in 2001, 89.9% hatched; this was higher than the 62.6% that hatched in 2000. We speculate the difference in hatching success between years to be due to an unusual heat wave in June 2000. Although the Alameda Point population has grown over time, factors that may be limiting colony growth and potential growth of the San Francisco Bay metapopulation (e.g., food availability, habitat constraints, and predation pressures) are currently being evaluated and researched.

Contaminant load in four species of pelagic seabirds

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Seabirds, due to their high trophic level and wide foraging ranges, are good indicators of contamination in the marine environment. In order to test the hypothesis that seabird contaminant body burden is determined by their trophic feeding strategy, we measured contaminant loads in four species of North Pacific seabirds: Black-footed Albatross (BFAL) (*Phoebastria nigripes*); Laysan Albatross (LAAL) (*P. immutabilis*); Red-tailed Tropicbirds (RTTR) (*Phaethon rubricauda*); and Wedge-tailed Shearwaters (WTSH) (*Puffinus pacificus*). Blood samples were collected from adult birds on Johnston Island (RTTR [*n* = 10], WTSH [*n* = 5]) and Midway Atoll (BFAL [*n* = 10], LAAL [*n* = 10]). Samples were analyzed for lead, arsenic, and cadmium using a Finnegan Element ICP-MS. Total mercury was analyzed by cold vapor AFS. Total PCBs and DDE were analyzed by gas chromatograph. Average blood concentrations (ng/ml) (SD) are shown in Table 1.

Levels in BFAL showed a 3-fold increase in DDE compared to values reported for 1992-93 (Auman et al. 1997). These data support the hypothesis that trophic feeding strategy is important for contaminants that bioaccumulate. Analyses of C and N stable isotopes will be conducted to further substantiate how trophic relationships affect different contaminant loads in these species.

Techniques for estimating seabird mortality from oil spills

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Numerous studies have demonstrated that only a fraction of the seabirds killed in most oil spills are recovered. Recovering damages for injury to

FIGURE 1. Contaminant load in four species of pelagic seabirds on Midway Atoll (Finkelstein et al.) See text for abbreviations of bird names.

	Pb	As	Cd	PCBs	DDE	Hg
BFAL	16 (9)	1000 (700)	19 (9)	135 (72)	108 (81)	2700 (900)
LAAL	10 (9)	500 (300)	22 (14)	45 (20)	28 (17)	800 (400)
RTTR	1 (0.3)	1300 (700)	3 (0.7)	8 (3)	2 (2)	700 (300)
WTSH	9 (4)	2600 (300)	21 (8)	4 (0.5)	2 (2)	70 (60)

seabirds, however, requires that defensible estimates of mortality be made. There are several alternative approaches for injury assessment that are applicable under differing circumstances, including the beached bird model, swept-through model, and changes in colony size. Studies carried out subsequent to recent spills, including the *New Carissa*, the *Stuyvesant*, and the *Kure*, have been used to reformulate the beached bird model and lend new insight on the swept-through model. I describe a proposed damage assessment methodology that promises greater accuracy but requires significant coordinated effort during the spill response phase.

Patterns of temporal and geographical variation in prey selection by three sympatric auklet species (*Aethia* spp.) in the Aleutian Islands, Alaska

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We compared variation among species, years and locations in prey selected by sympatric *Aethia* Auklets while they were provisioning chicks in the western and central Aleutian Islands. On Buldir Island, we collected

chick meals from Crested (*A. cristatella*), Least (*A. pusilla*), and Whiskered (*A. pygmaea*) Auklets during 1994-1997. On Kasatochi Island, chick meals were collected from Crested and Least Auklets in 1996 and 1997. We quantified prey selection and interspecific overlap using Principal Components Analysis (PCA) and Spearman Rank Correlations. Principal Component scores for PCI and PCII explained 81% of diet variance and indicated that euphausiids (*Thysanoessa* spp.) and *Neocalanus plumchris* were the most important coefficients for PCI, and *N. cristatus* and euphausiids for PCII. Crested Auklets delivered euphausiids and *N. cristatus* primarily, Least Auklets delivered the smaller copepod *N. plumchris*, whereas Whiskered Auklets had considerable annual variation in the proportions of euphausiids and both copepod species. On Buldir, Whiskered Auklets' prey overlapped considerably with that of both Crested and Least Auklets, but was most similar to that of Least Auklets. The prey of Least Auklets on Buldir varied more than those of Least Auklets on Kasatochi Island, probably due to oceanographic differences in foraging areas near the two colony sites. Our results provide no evidence for a role of competitive exclusion in determining species' prey selection during chick rearing. We suggest that auklet species respond independently, and somewhat opportunistically, to variation in food supplies and oceanography among breeding areas and among years.

Is there evidence of programmed mass loss in response to increased flight demands in breeding auklets on Saint Lawrence Island, Alaska?

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Body mass was measured in nesting Least Auklets (*Aethia pusilla*) and Crested Auklets (*A. cristatella*) on St. Lawrence Island, Alaska during June–August, 2000 and 2001, to assess within-season, inter-annual, and among-colony variation. Breeding adults were captured and weighed during incubation and chick rearing. Least Auklets are not sexually dimorphic, so they were not sexed. Crested Auklets were sexed by bill shape (Jones 1993). There was no detectable decline in mean adult body mass from mid-incubation through mid chick rearing for either species in either year ($P > 0.05$ for all cases). Thus there was no support for the hypothesis that a programmed mass loss occurred around hatching in response to increasing flight demands of parents feeding young at this site in these years. There were no significant between-year differences in mean adult body mass from mid-incubation through chick-rearing for Least Auklets ($P = 0.07$, two-sample t -test) or Crested Auklet males ($P = 0.52$, two-sample t -test). Female Crested Auklets, however, had lower mean body mass in 2001 than 2000 ($P = 0.03$, two-sample t -test). Previous work on St. Lawrence indicates that a seasonal decline in adult body mass of breeding auklets once occurred. Inter-annual variation and previously observed within-season declines in body mass suggest that seasonal mass change is facultative and dependent on energy reserves at the outset of the breeding season. Within- and between-year differences in auklet body mass may be a response to variation in zooplankton prey availability rather than adaptation to reduce flight demands during chick rearing.

Assessment of noise disturbance on nesting Marbled Murrelets in Redwood National and State Parks: a progress report

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In April–May 2001, we captured 23 Marbled Murrelets at sea and attached radio transmitters. Subsequently we located 5 nests within the Redwood National and State Parks. Based on radio-detected attendance patterns, 3 of these nests probably were successful in fledging young. We conducted a noise experiment using a chain saw at one of the successful nests during the chick-period. Overt changes in behavior (activity, posture) that could be attributed to the experimental disturbance were not apparent in analyses of video recordings during a 30-min pretrial period, the 15-min trial, or during 30-min post-trial period. Caution in interpretation of these data is necessary because of variation in nest locations, variation in ambient noise levels, and nesting stage.

Predation among the natives: direct and indirect interactions among eagles, gulls and salmon

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Increasing populations of Bald Eagles (*Haliaeetus leucocephalus*) in the Pacific Northwest impact seabird colonies along the outer Washington coast. For pairs of the Western Gull (*Larus occidentalis*)/Glaucous-winged Gull (*L. glaucescens*) hybrid complex, eagles directly and indirectly influence

breeding success. In colonies wholly comprised of gulls (Grays Harbor), eagle disturbances indirectly facilitate predation of gull eggs by congeners. At Tatoosh Island, where 10 seabird species breed on the island complex, eagles and eagle disturbances affect gulls, but eagles primarily reduce breeding success of Common Murres (*Uria aalge*) by facilitating predation of murre eggs by gulls and crows. In 1996 and 1997, when eagle pressure was low, gull breeding success was high. From 1998 to 2000, eagle pressure greatly increased, and predation of gull chicks by eagles resulted in near island-wide breeding failure in gulls. In 2001, eagle pressure declined to pre-1998 levels, and gull success was again high. While eagle pressure strongly impacts both gulls and murres, levels of breeding success of gulls on Tatoosh Island results from direct effects of predation on gull chicks rather than indirect facilitation of egg predation observed for murres. In the light of increasing eagle populations on the Olympic Peninsula and in the Pacific Northwest in general, the sudden reversal in eagle pressure is not easily explained, but may result from foraging switches or dispersal of individual eagles away from Cape Flattery. Overall eagle foraging behavior and diet during the seabird breeding season may also be influenced by increased salmon returns attributed to improved ocean conditions.

Terrestrial flights of radio-tagged Marbled Murrelets in Redwood National and State parks during the 2001 breeding season

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We followed 19 radio-tagged Marbled Murrelets (*Brachyramphus marmoratus*) on terrestrial flights from the ocean to inland sites within Redwood National and State Parks, Cali-

fornia. Five of the birds eventually nested, whereas 14 non-nesting birds routinely flew inland. We detected inland flights using a combination of stationary automated telemetry recorders and mobile human-operated telemetry. For individual nesting and non-nesting birds with adequate data, the timing of flights and geographical routes traveled were consistent. Across individuals, the timing of flights and landscapes used also had distinct patterns. One of the nesting adult birds showed a marked increase in conspicuous behaviors within the nest stand; these occurred before, and at least two weeks after, the fledging period. One non-nesting bird consistently vocalized and had a conspicuous flight pattern in one canyon that was frequently visited and near the terminus of the inland flight path. Automated telemetry recorders were useful in detecting presence of nesting and non-nesting birds at particular sites, but data should be periodically verified by observers with mobile telemetry equipment.

A tangerine-scented pheromone in a monogamous seabird

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Pheromones, chemical social signals, are well known in every living class of vertebrate except birds. The apparent absence is surprising, as every bird examined has a functional olfactory system, and some produce distinctive odors. The Crested Auklet (*Aethia cristatella*), a monogamous seabird, exhibits a distinctive tangerine-like scent during breeding that is closely associated with courtship activities. Using T-maze experiments, we tested whether birds preferred con-

specific scent or distinguished between different kinds of odors, two necessary pre-requisites for chemical communication. Four pieces of evidence indicate that the tangerine scent of the Crested Auklet is currently the best example of a pheromone in any bird: (1) attraction to conspecific feather odor; (2) attraction to a mixture of two volatile chemicals in feather scent (cis-4 decenal and octanal), which we identified as seasonally significant; (3) differential responses to odors, as indicated by preference for auklet scent, and aversion to mammalian musk, but no significant response to a novel odor, amyl acetate (banana scent); and (4) a striking relationship during mutual mate choice between feather odor and "ruff sniff" courtship displays. Although the social function of odors is just beginning to be realized in birds, such as Crested Auklets, future studies promise to reveal the more widespread use of chemical communication in avian species.

Oil tanker and ship operations in California

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During the 20th century, tens of thousands of seabirds were killed in California by oil tanker and barge spills. Following major tanker oil spills in Alaska (1989) and California (1990), state and federal legislation mandated many new oil spill prevention measures. The advent of harbor vessel-tracking systems, tug escorts, off-shore tanker routing, certificates of financial responsibility, requirements for double-hulled tankers, inspections, and spill contingency plans have contributed to a dramatic decline in tanker-related spills. Awareness of the significant costs of oil spill clean-up and the threat of criminal and civil financial

liability may have influenced industry performance standards. Although about 650,000,000 barrels of petroleum products are transferred through California waters annually, no significant seabird mortality has been attributed to accidental tanker spills in California in recent years. In contrast, non-tanker vessel spills, oil pipeline breaks, and chronic oil pollution have killed thousands of seabirds in California over the past five years.

Foraging ecology of endangered American White Pelicans in British Columbia

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The small population of American White Pelicans (*Pelecanus erythrorhynchos*) breeding at one location in British Columbia is designated "Endangered" under the BC Wildlife Act. Foraging occurs in shallow lakes, rivers, and streams as far as 165 km from the Stum Lake breeding colony, over an area 30,000 km². The average foraging lake ($n = 19$) is 1000 m above sea level, 321 ha in surface area, and 4 m in depth. Three years of aerial surveys (1999–2001) quantified large-scale patterns of foraging habitat use approximately every three weeks at 38 different lakes and stream reaches. The highest total daily count was 623 on May 4, 2001, and the highest count for an individual lake was 350 at Pantage Lake on July 10, 2001. Low elevation ice-free lakes in the vicinity of Williams Lake were used for foraging early in the breeding season (late April–early May) but not later in summer. By mid-September the total number of foraging pelicans dropped dramatically as birds migrated south for winter. A number of adult pelicans (≥ 77) also occurred approximately 200 km north of the breeding colony at Nulki, Tachick and Stuart Lakes, but the breeding status of these birds was not determined. Two years of ground surveys and observations (2000–2001) at 13 foraging lakes quantified small-scale

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habitat use patterns. Foraging occurred in shallow water along shorelines, at creek mouths, in streams, and in shallow open water in the middle of some lakes. Nocturnal foraging was common; it began shortly after dark and continued throughout the night and into the dawn. Stream foraging at night was only observed in the spring, and was thought to be associated with the spawning activities of coarse fish such as longnose suckers (*Catostomus catostomus*). In the morning, pelicans returned to traditional loafing sites, to rest and preen for a few hours before leaving the foraging lake. Loafing sites were mainly located on isolated sandbars, mud flat islands, and floating vegetation along marshy edges of lakes. Vanishing bearings of departing birds were usually consistent with the direction of the breeding colony. Pantage Lake consistently supported the highest number of open-water-feeding pelicans and had prey-capture rates that were three times higher (0.6 fish/pelican/min) than lakes with fewer shoreline-feeding pelicans (e.g., Owen and Tachick Lakes; 0.1–0.2 fish/pelican/min). Experimental approaches by researchers and observed approaches by other lake users elicited various reactions by pelicans, with some birds flying away when approached within 300 m, while others only swam away when approached to 50 m. Low-flying aircraft elicited flight responses at the greatest distance (200–300 m). Preliminary results from 5 pelicans equipped with backpack radio-transmitters and relocated 26 times in 2001 suggest individuals vary their use among different foraging lakes.

Big birds and tweetys: size-dependent persistence of beached birds

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Over the past two years, COASST (Coastal Observation and Seabird Sur-

vey Team) volunteers have tagged over 800 beachcast seabirds and averaged a survey rate of once every three weeks. Because each carcass is uniquely number-tagged and is not removed from the beach, we can calculate the duration of time that birds persist on the beach. Comparable, comprehensive observations have not been reported elsewhere. Our results are not too surprising—bigger birds tend to last longer. From July 2000 through June 2001, 15% of COASST carcasses found for the first time (untagged) were classified as "small to medium" (wing chord <25 cm); yet of 51 total re-finds during the same period, only 6% were similarly sized. If small birds are rediscovered as readily as large birds, the percentages should be similar. Furthermore, between July and December 2001, 45% of first-time finds were classified as "small to medium," while only 30% of re-finds were of similar size. Some of this "big bird" finding-bias must be due to the greater conspicuousness of larger birds (i.e., bigger targets for the eye). However, COASST scavenging data suggest that some of this discrepancy is also explained by the more rapid disintegration of smaller (and more fragile) birds. Why does this matter? First, it suggests that smaller birds are more likely to be missed when beached bird surveys are scheduled at longer intervals. Second, it means that historical beached bird surveys may have underestimated the relative proportions of small- to medium-sized species in relation to larger taxa.

Satellite telemetry of Alaskan seabirds

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The availability of transmitters in the 20–60 g range brings large- to medium-sized seabirds within the scope of wildlife telemetry via satellites. Application of this technology has been actively pursued in Alaska since 1994,

where 72 individuals of 6 species have been instrumented to date. The largest deployment involved Common Murres (*Uria aalge*), Thick-billed Murres (*U. lomvia*), and Tufted Puffins (*Fratercula cirrhata*) from three colonies in the Gulf of Alaska and Chukchi Sea. Wintering grounds of murres from Cape Thompson and Cape Lisburne were successfully identified in the southeastern Bering Sea, but the results of this study were limited by short battery life and high mortality among murres and puffins associated with surgical implants. Subsequent study of captive murres has informed but not completely solved the problem of post-release mortality, while improved battery life is available in newer transmitters. Pelagic Cormorants (*Phalacrocorax pelagicus*) and Glaucous-winged Gulls (*Larus glaucescens*) implanted on Middleton Island in 2000 were successfully tracked to their wintering areas and back over 7–13 months. Currently, we are tracking both adult and first-year gulls and cormorants implanted in August 2001. In June, we initiated a study of at-sea movements of Northern Fulmars (*Fulmarus glacialis*) using harness-mounted transmitters. Fulmars from St. George Island (Bering Sea) appear to forage over deep water near the continental shelf break. Fulmars also visit shelf waters east of the Pribilof Islands, behavior which is possibly associated with commercial fishing operations in the area.

At-sea movements of radio-tagged Marbled Murrelets off the coast of northern California

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In April and May 2001, 23 Marbled Murrelets (*Brachyramphus marmoratus*) were captured and radio-tagged off the mouth of Redwood

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Creek in northern Humboldt County, California, adjacent to the Redwood National and State Parks complex. Murrelets were subsequently tracked using fixed-wing aircraft flying over coastal at-sea foraging areas and old-growth forest nesting habitats on 94 days until mid-August. On average, 92.4% of murrelets with active radios were detected per flight. Murrelets foraged in near-shore waters between the mouth of Humboldt Bay, California, and Brookings, Oregon. Home range (95%) and core area (50%) fixed kernel polygons are compared between murrelets that attended and did not attend nest sites after capture, and between males and females (sexed with blood samples).

Comparison of bird detections during simultaneous radar and ground-based surveys for Marbled Murrelets in known occupied redwood habitat, Humboldt County, California

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During the breeding season of 2001, morning surveys were conducted for Marbled Murrelets (*Brachyramphus marmoratus*). There were one or more ground-based surveyors on each day, for a total of 87 person-surveys. Observations were made in an array of known murrelet stations, which also were covered by 1.3-mile radius Mobile Radar Unit. To assist in determining exactly what was being detected by the radar, all bird species were recorded. By using experienced surveyors, a typical Pacific Seabird Group protocol survey was modified to record the initial time and detection of both audible and visible bird detections. Additional attention was paid to birds flying over that might also be detected by the radar. The time and flight path were noted on a topographic map, as were any Marbled Murrelet detections. As well as allowing a comparison between ground-based murrelet survey detections and those by radar, the re-

sulting species list of birds present in this habitat type and the timing of their activity provided insight into which of the confusing species and predators were present at the time of murrelet survey activity. The most typical possible predators and confusing species were Common Raven (*Corvus corax*) and Steller's Jay (*Cyanocitta stelleri*), distant thrushes, Northern Flicker (*Colaptes auratus*), and aerial foragers. Murrelet activity levels and detectability are highly variable based on time of season and environmental conditions. Simultaneous murrelet radar and ground-based surveys are best conducted using an "all-species" approach with highly skilled observers.

Covariation of egg size and laying date in Thick-billed Murres breeding in the Low and High Arctic

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Few topics in ecology have received more attention than covariation of egg size and clutch size with laying date in birds. We compiled information on egg size and laying date from Thick-billed Murre (*Uria lomvia*) studies undertaken in the eastern Canadian Arctic in 1975 to 2001. Theory suggests that populations inhabiting harsh, variable environments should display greater plasticity in life-history traits than populations inhabiting more benign, constant environments. Consistent with this hypothesis, Thick-billed Murre populations breeding at High Arctic colonies (Prince Leopold and Coburg islands) showed greater inter-year variation in egg size and laying date than populations breeding at Low Arctic colonies (Coats, Digges, and the Gannet islands). Experiments showed that relaying capacity was

more variable in the High Arctic. In addition, egg size and laying date showed a strong negative correlation among years in the High Arctic, but there was no correlation in the Low Arctic. We conclude that the significance of constraints and strategies differs for Thick-billed Murre populations breeding across an environmental gradient.

Trophic levels and heavy metal concentrations of terns at two California nesting colonies

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We determined the stable carbon and nitrogen isotope values and heavy metal concentrations for Caspian Tern (*Sterna caspia*), Elegant Tern (*S. elegans*), and Forster's Tern (*S. forsteri*) and their fish prey at the Bolsa Chica Ecological Reserve in southern California and, except for Elegant Tern, in south San Francisco Bay during the 1997–1999 breeding seasons. Values for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ and concentrations of a wide variety of metals were obtained for abandoned eggs and livers of dead chicks of these tern species and for several prey species. In this presentation, we focus on a comparison of copper, zinc, mercury, and cadmium concentrations in eggs vs. livers and on the relationship between Hg level and $\delta^{15}\text{N}$ value within and among tern species. A significant increase (*t*-test) in the concentrations of Cu and Zn from eggs to livers was observed in the tern species at both sites. Conversely, Hg levels, with one exception, were significantly higher (*t*-test) in the eggs than in the livers. The small range of $\delta^{15}\text{N}$ values indicates that the birds feed on virtually the same trophic level

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and, thus, Hg biomagnification was not apparent. Cd concentrations were essentially at detection limits for all samples analyzed indicating limited bioavailability. Our results show marked differences in the concentrations of the four metals in eggs and livers, which appear to reflect not only differences in their bioavailability at the two sites but also in their requirements for physiological processes.

Growth patterns of Pigeon Guillemot chicks in captive feeding trials

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Captive rearing studies were performed using 153 Pigeon Guillemots (*Cepphus columba*) at the Alaska SeaLife Center during the period from 1998 to 2000. Chicks were raised on fish diets of varying proximate and whole-body energy compositions, and growth parameters were monitored prior to the start of the fledging period (post-hatch day 30). Chick daily energy intakes varied from an average of 607 kJ/day to 933 kJ/day for nine different experimental groups. A high degree of correlation was found for mass growth increments (post-hatch day 15-30) with total daily energy intakes ($y = 0.26x - 38.42$, $r^2 = 0.835$). However, increased diet quality (lipid content) did not correlate with these incremental mass accumulations ($r^2 = 0.239$). The wing chord increment during this same period of time was not correlated with daily energy intake ($y = -0.0003x + 63.897$, $r^2 = 0.0013$). Assimilation efficiencies were calculated for three of the diet groups (*ad libitum*, 933 kJ/day; high lipid, 874 kJ/day; low lipid, 608 kJ/day), and the *ad libitum* group showed significantly lower efficiency ($82.0 \pm 0.83\%$) than either the high lipid ($83.5 \pm 0.66\%$) or the low lipid ($84.0 \pm 0.54\%$) groups. These results suggest that the main determinant of pre-fledgling chick mass accumulation

in the energy range of diets analyzed is total energy intake, and not the quality of diet.

Progress in ship rat eradication from Anacapa Island, Channel Islands National Park, California

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Rattus spp. have been introduced to 80% of island groups worldwide and are responsible for an estimated 40-60% of recent bird and reptile extinctions. On Anacapa Island, Channel Islands National Park, black rat (*R. rattus*) predation is believed to be a major factor in limiting Xantus' Murrelet (*Synthliboramphus hypoleucus*) and perhaps Ashy Storm-Petrel (*Oceanodroma homochroa*) numbers. Rat eradication programs are valuable tools to protect seabird species. Rats have been eradicated from 13 islands in North America using a grid of bait stations refilled regularly with rodenticide bait for 1-2 years. However, on many islands, such as Anacapa (296 ha), bait stations cannot be used due to steep topography and sensitive species. Eradications using aerial broadcast of rodenticide bait have been successful on at least 5 islands. Anacapa will be the first island in North America where rats will be eradicated using an aerial broadcast. Consequently, extensive regulatory paperwork was required including environmental compliance and EPA registration. In fall 2000, we conducted a trial aerial broadcast of 25-ppm brodifacoum pellets spread at 15 kg/ha on a 2.5 ha test plot. All 10 radio-collared rats died, and none of the 10 ear-tagged rats were recaptured post broadcast. None of the 74 ear-tagged endemic deer mice (*Peromyscus maniculatus anacapae*) were recaptured, but deer mice recolonized the test plot

within 6 weeks and were breeding there by 6 months post-broadcast. Planned mitigation for deer mice includes captive holding with timed release and follow-up monitoring.

Investigations of Marbled Murrelet nesting habitats using a geographic information system (GIS) and radio-telemetry in Desolation Sound and Clayoquot Sound, British Columbia, Canada

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Marbled Murrelets (*Brachyramphus marmoratus*) are Pacific seabirds of conservation concern. Here we report on 84 nest sites found in 1998-2000 in Desolation Sound, and 21 nest sites located in 2000-2001 in Clayoquot Sound, British Columbia, Canada. We captured and radio-tagged murrelets on the water and subsequently located nests during systematic aerial searches during the birds' incubation periods. We determined nesting success from aerial survey data and climbed all trees that could be accessed from the ground, confirming the presence of nests in all such cases. For Desolation Sound, fifty nests occurred in Old Forest polygons, as classified on GIS forest cover maps. The remaining 31 were found in non-contiguous "Old Forest scrub" and smaller (<200 ha) Old Forest patches. Most nests fell within 100 m of Old Forest polygon edges. We investigated the influence of topographic features on nest site habitat selectivity and nesting success. These topographic characteristics of nest sites were compared to randomly selected locations in a 50-km radius circle centered at the aquatic capture site, using 1000 samples generated using a GIS and a GLM (Generalized Linear Model) for each analysis. For Desolation Sound, nests typically oc-

ed on steeply sloped sites at mean elevations of 748 m. Marbled Murrelets strongly selected nest sites on upper slopes, even when the topographic distribution of Old Forest habitat was taken into account. Nesting success was higher on steeper slopes and at higher elevations. Due to smaller sample sizes, our results from Iquo Sound are not significant, but are consistent with findings from Iquo Sound.

Sooty Shearwaters (*Puffinus griseus*) of eastern Canada: spatial and temporal patterns of pelagic abundance, 1966-1992, for a long-distance migrant from unknown origin

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Sooty Shearwaters (*Puffinus griseus*) have received little attention in the Northwestern Atlantic. The status and the origin of Sooty Shearwaters in northeast American waters are poorly known. Using the PIROP (Programme Intégré des Recherches sur les Oiseaux Pélagiques) database, owned by the Canadian Wildlife Service and covering at-sea observations from 1966 to 1992, we investigated and describe the spatial and temporal patterns of pelagic abundance for Sooty Shearwaters off Eastern Canada. Yearly and monthly mean abundance are shown; selected habitat links and behavior data are presented. In addition, monthly distribution patterns, flock sizes of all Sooty Shearwater sightings, and birds reported in molt are mapped and evaluated. We describe how Sooty Shearwaters are distributed in comparison to Greater Shearwaters (*P. gravis*), another long-distance migrant from the southern hemisphere occurring in Canadian waters during the summer and fall season. Our findings present the first pelagic estimates for populations

and food consumption. The effect of El Niño and other events, relevant to the Southern Hemisphere where these birds breed, are shown for Northwestern Atlantic sightings of Sooty Shearwaters.

Seabird surveys at sea: hotspots of ocean productivity and implications for the design of pelagic marine reserves

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Marine protected areas (MPAs) have gained enormous popularity in recent years as a tool to protect endangered species and to enhance marine biodiversity. Because many pelagic species use relatively predictable habitats, MPAs could be designed to protect foraging aggregations, migration corridors, and breeding grounds. Additionally, MPAs could help achieve ecosystem-level conservation objectives by protecting areas of high productivity and biodiversity. However, because different management objectives will require distinct MPA design concepts, we consider three distinct conservation targets: food-webs, biodiversity, and endangered species. In this presentation, we illustrate potential MPA designs off southern California (CalCOFI region) and British Columbia (Line P survey) on the basis of cetacean and seabird distributions with respect to bathymetrically defined habitats. Analyses of vessel-based surveys revealed that continental shelf-slope regions support abundant and diverse seabird and cetacean assemblages. In particular, many seabird species including far-ranging Sooty and Buller's Shearwaters (*Puffinus griseus* and *P. bulleri*), post-breeding alcids (Cassin's [*Ptychoramphus aleuticus*] and Rhinoceros [*Cerorhinca monocerata*] auklets), and southern visitors

with an affinity for warm water (Xantus's Murrelet [*Synthliboramphus hypoleucus*] and Pink-footed Shearwater [*Puffinus creatopus*]) occur along the shelf-break and the slope. These results suggest that MPA designs could focus on protecting relatively small (100s-1000s km²) oceanic habitats defined by "static" bathymetric features. In particular, geographically restricted regions, where narrow continental shelves concentrate the organisms that migrate along the shelf and slope, might be ideal sites for MPA zoning. For instance, the Point Conception region off southern California could deserve special conservation attention due to the dense and predictable concentrations of cetaceans and seabirds across a relatively narrow continental shelf.

Sex differences in Razorbill parent-offspring vocal recognition

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We investigated parent-offspring recognition by vocalizations in the Razorbill (*Alca torda*), in which both parents tend to the chick at the nest site, after which the male pair member is almost always the sole caregiver for a subsequent period at sea. In Razorbills and at least two other auk species, the switch from bi- to uniparental male care occurs during the expected critical period of development for parent-offspring vocal recognition. We have thus hypothesized that parent-offspring recognition would be paternally biased. We tested this hypothesis with vocal playback experiments conducted on Razorbills at the Gannet Islands, Labrador. The results of our experiments provided clear evidence of mutual vocal recognition between the male parent and chick, but not for the female parent and chick. Additional playback experiments provided suggestive, but

not conclusive, evidence that adult females recognize their mates' vocalizations. Taken together, the results support the original hypothesis that parent-offspring may be male biased. Such a bias is likely to have important social, and ultimately evolutionary, implications.

Distribution of foraging shearwaters with respect to the Inner Front of the southeastern Bering Sea

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The inner front is a structural front, which separates the well-mixed coastal domain from the two-layered middle domain of the southeastern Bering Sea, and has been hypothesized to be an important foraging area for Short-tailed Shearwaters (*Puffinus tenuirostris*). To test this hypothesis, we surveyed the spring and fall distribution of Short-tailed Shearwaters in the vicinity of the inner front at several locations in 1997, 1998, and 1999. We predicted that shearwater distribution in the southeastern Bering Sea was the result of shearwaters being attracted to the front where euphausiids aggregated to forage on phytoplankton stocks throughout the summer. We found that euphausiids were not more abundant at the front than elsewhere in our study areas. Nevertheless, in 1997 and 1999 foraging shearwaters were more abundant than expected by chance in frontal areas than elsewhere along the transects. In 1998, foraging shearwaters were more abundant than expected by chance inshore of the frontal zone. Shearwater diets varied among years. We hypothesize that interannual differences in hydrographic structure and the abundance of different prey species

influenced foraging locations in shearwaters.

Long-term trends in carbon flux to guano-producing seabirds in the Peruvian upwelling system

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The long-term time-series on abundance of guano-producing seabirds off Peru shows two opposite trends during the last century. First, there was a major population increase from 1925 to 1955 that has been attributed to seabird recovery from uncontrolled exploitation of guano. Later, seabirds underwent a severe decline from 1955 to 1965, from which the birds never recovered. This decline has been attributed to the industrial fishery for anchovies, the main prey of these seabirds, which became the largest fishery in the world in the 1960s. We hypothesized that fluctuations in the guano-producing seabird population of Peru were indirect responses to changes in the primary and secondary production of the upwelling system. To test this idea, we modeled nitrate input to the upper layers through upwelling by using data on wind stress and sea surface temperature. We used this model to predict the amount of carbon fixed by primary production between 6° S and 14° S, which was then apportioned to anchovy biomass and ultimately to the seabird population. The model explains 72% of the variation in seabird abundance from 1925 to 2000. Model results suggest that seabird population growth from 1925 to 1955 was likely a response to increased productivity of the Peruvian upwelling system and not an effect of seabird management. The decrease in numbers of guano-producing seabirds during the 1960s, and low population levels later on, may have been due to competition for food with the fishery, which re-

moves 85% of the prey otherwise available to seabirds.

The use of ultrasound scanning to determine the sex of Marbled Murrelets (*Brachyramphus marmoratus*) captured at sea

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Visualization of avian gonads by ultrasound yields little information when the gonad is quiescent. However, during the breeding season, this technique may allow a fast non-invasive method for determining the sex of individuals of monomorphic species. We used ultrasound scanning to determine the sex of Marbled Murrelets (*Brachyramphus marmoratus*) captured at sea off the coast of Northern California. Birds were positioned in dorsal recumbency and scanned ventro-medially through the brood patch. Ultrasound scans were video-recorded, and later reviewed to verify gonadal assessment made during the actual scan. Of 23 individuals captured, blood samples for 20 individuals were processed to confirm ultrasound assessments. Five murrelets could not be examined due to the absence of a brood patch. Of the remaining 15, six were initially deemed inconclusive, as a definitive gonad was not identified. The remaining 9 birds were identified as female. Later DNA analysis revealed that 6 of 9 birds were assigned the correct sex. The 3 mis-assigned birds were all males. The ultrasound tapes were later reviewed after capture. After review, only 3 scans remained inconclusive in sex assignment. Of the remaining 12 one individual was assigned as a male, and the remaining 11 were assigned as females. In this instance, 10 of 12 sex assignments based on review of ultra-

tapes were correct. The 2 incor-
assignments resulted from large
being misidentified as ovarian
es. These results indicate that a
le high quality ultrasound scan-
an be used to determine sex of
led Murrelets. Reviewing the
-recorded scans improved the
acy of ultrasound differentiation
sexes.

Effects of foraging behavior and -activity budgets on field meta- c rates of Black-legged Kitti- es

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We sought to determine the effect
of variation in time-activity budgets
and foraging behavior on energy ex-
penditure rates of Black-legged Kittiwakes (*Rissa tridactyla*) raising young
at a colony in Prince William Sound,
Alaska. We quantified time-activity
budgets using direct observations of
radio-tagged adults, and simultane-
ously measured field metabolic rates
(FMR) of these same individuals using
the doubly labeled water technique. We
used this combined data set to quantify
activity-specific metabolic costs across
a range of activities. Estimated meta-
bolic rates of kittiwakes attending their
brood at the nest or loafing near the
colony were similar (ca. 1.3x BMR),
although loafing during foraging trips
was more costly (2.9x BMR). Meta-
bolic rates during commuting flight
(7.3x BMR) and searching flight (6.2x

BMR) were similar, while metabolic
rates during plunge-diving were much
higher (ca. 47x BMR). The proportion
of the measurement interval spent for-
aging had a strong, positive effect on
kittiwake FMR ($r^2 = 0.68$), while the
combined proportion of time engaged
in nest attendance and loafing near the
colony had an equally strong but nega-
tive effect on FMR ($r^2 = 0.72$). Thus
more than two-thirds of the variation in
FMR among individual kittiwakes
could be explained by the allocation of
time amongst various activities, re-
gardless of individual differences in
activity-specific metabolic costs. The
high energetic cost of plunge-diving
relative to straight flight and searching
flight suggests that kittiwakes can op-
timize their foraging strategy under
conditions of low food availability by
commuting long distances to feed in
areas where gross foraging efficiency
is high.

Pre-breeding attendance by Com- mon Murres on central California nearshore colonies

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Winter colony attendance is well
known for Common Murre (*Uria
aalge*) populations at southerly lati-
tudes in the Pacific and Atlantic
Oceans and is thought to involve site
defense and prospecting behaviors. At
central California colonies, it is known
to occur widely but has been little
studied. As part of an ongoing restora-
tion effort focusing on Common Murre
populations in Central California, near-
shore colony attendance was followed
at three locations in the years
1999–2001. The study sites included: a
complex of sites at Point Reyes Head-
lands, the restoration site on Devil's
Slide Rock, and a complex of sites

comprising Castle/Hurricane Rocks.
Standardized counts (i.e., average of
three consecutive counts taken between
1000 and 1400 hours from a designated
overlook) were conducted opportunisti-
cally from mid-winter to the pre-
laying period (1 January–15 April) and
were compared to counts conducted
during the following breeding season.
On winter days when murres attended
colonies, 47–128% of summer num-
bers occurred on colonies. Winter col-
ony attendance was more frequent and
numbers were more consistent between
days at Devil's Slide Rock than at other
colonies. This pattern is of interest be-
cause the murre population on Devil's
Slide Rock exists in close proximity to
social attraction equipment being used
in the restoration process, while the
colonies at Point Reyes and Cas-
tle/Hurricane remain in a more natural
state.

The foraging behavior of Little Auks in a heterogeneous environment

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The Atlantic sector of the Arctic is
currently undergoing large-scale
changes in the distribution of water
masses. In recent years, the area sur-
rounding Little Auk (*A. alle*) colonies
on Svalbard has experienced an in-
crease in the inflow of Atlantic derived
water. In this study, the influence of
water mass distribution on the foraging
behavior of Little Auks was examined
through measurements made both at a
colony in Hornsund fjord (77° 03' N,
15° 10' E) and at sea. In the colony, we
measured chick diets and foraging trip
lengths. While at sea, we assessed the
distribution of foraging Little Auks and
the zooplankton available to them
within different water masses. Our
results indicate that Little Auks feed
mainly on the copepod *Calanus gla-*
cialis. They may restrict their foraging

activity to Arctic water masses that contain this large copepod and avoid Atlantic-derived water that contains a smaller copepod (*C. finmarchicus*). This study will help determine the potential impacts of climate change on Little Auks breeding on Svalbard. During years when the flow of Atlantic water increases and Arctic water decreases, Little Auks may be forced to forage in areas with sub-optimal conditions. In addition, we evaluate the potential of the Little Auk as an indicator of climate change and the parameters of their breeding biology and foraging ecology that would be sensitive to shifts in oceanographic conditions.

A brief on American White Pelicans

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Pelicans are the embodiment of an older age. Their ancestors date to the Pliocene, and their chalky white eggshells reflect their reptilian heritage. Pelicans became pelicans long before man became man, but almost from their first interaction, pelicans have inspired (and suffered from) mankind. The Psalmist, David, may have been the first to write about pelicans. Biology languished until Peter Ogden reported on American White Pelicans (*Pelecanus erythrorhynchos*) during his 1825 expedition to Utah. Brief accounts of pelicans by ornithologists continued through the 1950s. In subsequent decades, graduate theses and scientific publications finally detailed some pelican ecology. Documenting numbers of American White Pelicans has been difficult, and estimates of adults began at 30,000 in 1933, increased to over 100,000 by 1985, and by 1995 the total number, including non-breeders, was concluded to be 400,000. Currently, the life of a pelican is not an easy one. Beginning in the 1880s their feeding and nesting areas were degraded by human diversion of water and drainage of wetlands for agriculture. Simultaneously, pelicans

were shot and clubbed, and their eggs and young were destroyed—all because the birds simply ate fish. By the 1960s, pelicans began dying from insecticide poisoning, and in the following decades, hundreds of pelicans died each year from toxaphene, endrin, and dieldrin in the fish they ate. Recently, things have not seemed to improve: in the winter of 1998–99, 800 pelicans died in Florida from poisoning by insecticides as they leached from recently flooded agricultural fields. This mortality occurred just after a disease pandemic in 1996 at Salton Sea killed over 8,500 White Pelicans in just several months. Lower numbers continue to die at Salton Sea each fall.

Oil spill settlements and seabird restoration in California

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Government-led seabird conservation and management actions in California prior to about 1995 consisted largely of modest, locally focused, uncoordinated protection efforts. The presence of multiple trustee agencies, lack of funding, and disparate jurisdictional boundaries have impeded seabird management in California. Beginning in the mid 1990s, three trustee agencies initiated coordinated seabird restoration programs funded through damage claims secured primarily under the Oil Pollution Act of 1990. As a result, seabird conservation in California entered a new era in which multiple trustee agencies coordinated through trustee councils and guided by court approved settlement agreements administered seabird restoration trust funds greater than any previous funding levels. Currently, about \$14 million in five trust funds are, or soon will be, applied to

seabird restoration programs. Highlights of the five programs are described. The opportunity exists now, through these councils, to implement coordinated restoration plans that will advance a statewide seabird conservation strategy.

Reproductive variability among and within kittiwake colonies on Kodiak Island, Alaska

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Over the past three decades, researchers have documented marked inter-annual and regional variability in the reproductive output of Black-legged Kittiwakes (*Rissa tridactyla*) in the Gulf of Alaska and Bering Sea and have attributed these patterns to variations in food supply. Although breeding success can vary among different sub-sections of kittiwake colonies within a given breeding season ("patchy" productivity), the phenomenon has received relatively little attention from researchers and is usually attributed to localized effects of weather, predation, parasites, bird quality, or social facilitation. In 2001, we studied the foraging and breeding ecology of kittiwakes in Chiniak Bay, Kodiak Island, Gulf of Alaska as an integrated component of the Gulf Apex Predator-Prey project (GAP). We evaluated reproductive variability of kittiwakes breeding in 26 discrete colonies within Chiniak Bay by pooling our data with comparable observations for past years. We found variability in productivity both between years and among breeding colonies, despite the close proximity of colonies within Chiniak Bay and presumed overlap of foraging areas. Additional analyses found that kittiwake productivity differed between sub-sections of colonies within years, was consistent across years for a given

lony, and, inexplicably, was greater for "new" colonies that became established in the mid 80s than in "old" colonies established prior to the first monitoring efforts in the mid-1970s. Collectively, our results discount prey abundance and localized weather hypotheses as explanations for winter patterns of reproductive success for kittiwakes in Chiniak Bay: individuals in neighboring colonies can experience similar micro-climatic conditions and, in principle, have equal access to common food resources, yet still differ markedly in reproductive output.

Interactions between American White Pelicans and commercial aquaculture in the southeastern US

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USDA Wildlife Services offices in Arkansas, Louisiana, and Mississippi began receiving complaints concerning American White Pelicans (*Pelecanus erythrorhynchos*) foraging in commercial channel catfish (*Ictalurus punctatus*) ponds in 1990. Because of the relatively shallow pond depth and high fish stocking rates used by most producers, commercial catfish ponds provide a near perfect foraging environment for American White Pelicans and other piscivorous bird species. Damage abatement recommendations for White Pelicans have consisted of harassment measures similar to those used for other piscivorous birds, issuance of depredation permits, and draining water from fields used as loafing sites. Since 1993, biologists at Wildlife Services, National Wildlife Research Center have conducted research to learn more about pelican numbers and movements. Here, I provide an overview of past, current, and future research on American White Pelican interactions with southeastern aquaculture.

Current population status of the American White Pelican

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Breeding surveys were regularly conducted at most American White Pelican (*Pelecanus erythrorhynchos*) colonies until the early 1980s. Using survey data collected from 1979 to 1981, the North American population had been estimated at >100,000 breeding birds in 55 colonies. Although many pelican colonies have not been surveyed since the early 1980s, we present the most current (1999–2001) survey numbers available for all of North America. The pelican population west of the Rocky Mountains has declined considerably from historical numbers, while the eastern population apparently has increased. A few eastern and western colonies have been surveyed regularly for many years. Individual colony numbers, trends and status will be discussed where data are available. We recommend a coordinated, continent-wide survey be conducted in the near future.

Effect of underwater 3D seismic activity on molting Long-tailed Ducks

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Oil exploration in offshore waters typically involves conducting three-dimensional underwater seismic tests. We investigated the effects of such

tests on molting Long-tailed Ducks (*Clangula hyemalis*) in the barrier island lagoon system of the Beaufort Sea, Alaska, in August 2001. Using a Before/After/Control design, we compared the number, movement, and feeding behavior of Long-tailed Ducks within the seismic study area and two control sites. Over 100 Long-tailed Ducks were equipped with radio transmitters, and their movements and feeding activity were documented by means of remote automated data collection computers, human-operated triangulation stations, and aerial tracking. Aerial surveys indicated the number of Long-tailed Ducks declined during the study on both the seismic and control areas. About half of the radio-equipped ducks left the seismic study area by the middle of August, after 1–2 weeks of seismic activity, traveling east into one of the control areas. Similar eastward movements were observed in both control areas, although to a lesser degree. This movement may be related to a sustained period of southwesterly winds, which drove ducks into more protected areas within the lagoon system. There was no discernable difference in feeding behavior in ducks from the seismic and control areas. Overall, we did not find any sizeable effect of seismic activity on Long-tailed Ducks, although our ability to document effects were rather coarse and may have missed more subtle effects of seismic activity on Long-tailed Ducks.

An integrated approach to evaluate the impact of fisheries bycatch mortality on Black-footed Albatross

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Pelagic longline fisheries worldwide incidentally take long-lived seabird species. This mortality has already led to fisheries restrictions to protect seabirds, including Wandering Albatross (*Diomedea exulans*) in the Southern Ocean. Fisheries impact assess-

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ments for other seabirds could identify other species that would benefit from management intervention before they become threatened. But quantifying seabird bycatch is difficult; the data are generated by fisheries observers and by multinational fleets operating in vast oceanic regions. Here we present a case study to quantify mortality of Black-footed Albatross (*Phoebastria nigripes*) from pelagic longlines in the North Pacific, and assess the population-level impact of this mortality. Our results suggest that even with best-case estimates of mortality, population declines are likely for this species. Although this analysis requires extensive estimation and extrapolation from existing data, it is critical to provide fisheries managers with bounded estimates of likely

Pigeon Guillemot diving behavior during midwater and demersal foraging

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Many seabirds feed on both midwater and demersal prey, but little is known about the relative costs of foraging in these two habitats. We used radiotelemetry to measure dive parameters for 26 Pigeon Guillemots (*Cepphus columba*). Some individuals specialized on demersal fishes, and others fed mostly on midwater fishes (Pacific herring [*Clupea harengus*] or Pacific sand lance [*Ammodytes hexapterus*]). We measured the duration of dives and subsequent surface intervals and the number of dives in each bout. Dive duration increased with water depth for birds feeding on demersal fishes, confirming that this group foraged on the sea floor. Dive duration was negatively correlated with depth for birds feeding on midwater fish, suggesting that they foraged mostly in

the water column. Peak dive:surface ratios for the demersal group occurred during dives of intermediate duration (60–70 s), and longer; deeper dives required proportionately more surface recovery time. Increased surface times after these deep dives probably reflect the time required to replenish oxygen stores in myoglobin and hemoglobin. The resulting decrease in time spent at the foraging patch reflects the cost of feeding in deep habitats by the demersal group. Guillemots feeding on midwater prey averaged 60% fewer dives per bout than those feeding on demersal fishes, but they also had longer individual dives and peak dive:surface ratios were 150% greater than those of the demersal group. We suggest that longer dives and higher dive:surface ratios reflect the costs of preying on unpredictably located schooling midwater fish.

Assessing impacts of Caspian Tern predation on juvenile salmonids in the Columbia River estuary

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Estimates of Caspian Tern (*Sterna caspia*) consumption of juvenile salmonids (*Oncorhynchus* spp.) in the Columbia River estuary have ranged from 11.7 million smolts in 1999, when most terns nested on Rice Island, to 5.9 million smolts in 2001, when all terns nested on East Sand Island. We used an age-structured matrix population model framework (CRI; developed by the National Marine Fisheries Service [NMFS]) to assess the impact of this juvenile mortality on returns to the Columbia River of adult salmonids that are listed under the Endangered Species Act. For Evolutionarily Significant Unit stocks (ESUs) of steelhead (*O. mykiss*), we estimated that the average annual population growth rate

(λ) would increase 0–1.7% as a result of relocation of the tern colony; this estimate would depend on additive/compensatory mortality assumptions. The hypothetical scenario of completely eliminating tern predation could potentially increase λ by 3.3%, if this mortality is assumed to be completely additive. These estimates of changes in λ can be compared to estimates for reducing predation by northern pike minnow (*Ptychocheilus oregonensis*) ($\Delta\lambda = 0.4$ –0.7%, depending on ESU and assuming entirely additive mortality), or NMFS's estimates for other potential salmon recovery activities, such as complete elimination of harvest (4–12%), altered management of the hydropower system (3–15%), or breaching of four dams on the Snake River (6–27%, depending on assumptions regarding delayed mortality). Most listed ESUs appear to require 5–15% increases in λ to change the population trajectory from negative to positive (i.e., $\lambda > 1$). Management of Caspian Tern predation alone apparently will not reverse salmonid declines; however, it could contribute to a broader, comprehensive strategy to achieve sustaining populations of salmonids in the Columbia River Basin.

Marbled Murrelet group size on the water: can it be used as an index to productivity?

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Marbled Murrelet (*Brachyramphus marmoratus*) population demographics are difficult to measure. Population size can be estimated from at-sea densities, and productivity indices can be derived from ratios of hatch year to after-hatch year birds as observed from surveys on the water. However, there is no way to determine from marine surveys alone what pro-

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portion of the Marbled Murrelet population sampled at sea is nesting in any given year, allowing a more meaningful interpretation of productivity ratios. We hypothesized that group size (the number of murrelets occurring together on the water) could provide such an index if it could be demonstrated that single murrelets detected on the water during the incubation phase of the nesting season represent nesting birds. We monitored radio-tagged murrelets in Desolation Sound, BC, during 29 May–19 June 2001, using an incubating pair's distinct 24-hour on-off occurrence on the water to determine nesting status. Of 160 murrelet groups comprised of at least one individual of known nesting status, 67% of singles, 39% of pairs, and 53% of larger groups were incubating. Among non-nesting groups, 13% were singles, 50% were pairs, and 36% were in groups of >2 birds. Group size was an ambiguous indicator of nesting status. However, our results suggest that group size, especially the proportion of single-bird groups, may help assess the proportion of murrelets that are nesting. Multiple-year comparisons of group size with nesting rates are needed to validate and interpret these results.

Impacts of the Norway rat on the Least Auklet breeding colony at Sirius Point, Kiska Island, Aleutian Islands, Alaska

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Norway rats (*Rattus norvegicus*) were accidentally introduced to many Pacific Islands during World War II, including Kiska Island, Rat Islands group, Aleutian Islands, Alaska. During the breeding season, Kiska has an extremely large (>1 million birds) Least Auklet (*Aethia pusilla*) colony, which serves as a food source for introduced rats. Least Auklet adults (85 g) are an ideal sized prey for Norway rats (>200 g). Since they are crevice-nesters, Least Auklet adults and their chicks and eggs are vulnerable to rat

predation. In 2001, Least Auklet fledging success at Sirius Point, Kiska was much lower than at Buldir and Kasatochi Islands, where there are no rats. One reason for this low fledging success may have been rat predation. I propose to quantify Least Auklet survival and productivity in 2002 and 2003 at Kiska for comparison with islands without rats. I will use stable-isotope analysis of rat tissue to evaluate their trophic level. I propose to collect rats at pre-set locations on Kiska and other islands for a comparison of rat ecology across the Rat Islands landscape. Rats will be collected through the summer using snap traps set around the Sirius Point colony, the Kiska lakes 10 km away, at Kiska Harbor, and from other islands, including Rat Island. Tissue from the entire food chain will be collected (plant material, intertidal invertebrates, auklet chick meals, rats, auklets, eagles) from these areas. This will give an insight to the significance of Least Auklets in the diet of the rats during the breeding season.

The influence of food quality on reproductive performance in an Arctic Tern population

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I studied the influence of food quality on reproductive performance in Arctic Terns (*Sterna paradisaea*) at Matinicus Rock, ME during 1999 and 2000. At the population level, the Arctic Tern appears to be a generalist predator. The species has a mixed diet consisting of 60% fish and 40% invertebrates by occurrence. On the pair level, Arctic Terns have strikingly different provisioning strategies. Most pairs of terns provision chicks with high quality fish, while a few provision chicks with mostly low-quality invertebrates. Based on past studies purporting to show that food quality influences reproductive performance, I hypothesized that reproductive performance would be lower for Arctic Tern

pairs provisioning chicks with low-quality invertebrates. Results show that pairs provisioning with low-quality invertebrates have the same reproductive performance as pairs that provision with fish. I proposed two hypotheses to account for the lack of relationship between food quality and reproductive performance: (1) the contribution of invertebrates to the total energy delivered to the nest is small, and (2) terns feeding invertebrates may increase provisioning rates so that young receive the same rate of energy input as those fed fish. Analyses of foraging trip lengths and energy density of prey show that terns compensate for low-quality food by increasing the rate of provisioning. The ability to shift to invertebrate prey may allow terns to reproduce successfully in years when fish are scarce.

Comparison of habitat availability measures to examine seabird at-sea habitat use

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We compared habitat availability measures for examining at-sea habitat use of seabirds on aerial strip transects off southern California. Analyses were conducted with ArcInfo/ArcView geographic information system and SAS statistical software. Habitat use was assessed using bird densities calculated within 1-minute latitude/longitude blocks. We compared two methods for measuring habitat availability within each block. Example habitat variables examined were depth, slope, and distance to land. In Method 1 (based on previous studies), water depth and slope were averaged over a bathymetric grid within each 1-minute block.

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Distance to land was measured from the midpoint of each block to the nearest point of land. In Method 2, these variables were averaged within each 1-minute block from a series of GPS points recorded about every 250 m during surveys using the computer program dLOG. Depth and slope were calculated for each GPS point using the same bathymetric grid as for Method 1. Also, each habitat variable was calculated at each bird observation. The locations of bird observations were interpolated from nearby GPS points. The main benefit of Method 1 is that analyses of multiple surveys are performed using a common database of habitat variables. However, preliminary analyses show that Method 2 measures, which are derived from actual survey trackline data, generally correlate better with habitat at actual bird observations.

Oil and gas operations offshore of California: status, risks, and safety

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Offshore oil operations in California are conducted from 23 platforms in Federal waters (>3 miles from shore) and from 10 platforms and related facilities in State waters (<3 miles). These structures are distributed over an area of about 20,000 km² along the southern coast of the state. In 2000, about 36 million barrels (bbl) of oil were produced from Federal waters, all of which was transmitted to shore by pipeline. In comparison, over 250 million bbl of crude oil and distillates (e.g., gasoline) are transported by tanker along the California coast each year.

The largest oil spill from offshore oil operations in California was the 1969 80,000-bbl Santa Barbara spill, which resulted in the loss of thousands of birds. This spill was a pivotal event for both the environmental movement in the US and for offshore oil safety. After 1969, the rules and regulations

governing offshore oil were rewritten and new rules were developed. Since 1969, only one spill from offshore oil in California has involved birds, the 1997 163-bbl Torch spill off Point Pedernales, which resulted in the loss of 600–800 birds. Although only a few small spills have occurred since 1969, there is a possibility of other spills occurring in the future. Based on the amount of offshore oil expected to be produced in California over the next 5 years and the number of spills that have occurred in the past, the risk of a major spill (>1000 bbl) occurring during that period is about 16%.

Temporal changes in the seabird colonies of Isla San Jorge, northeastern Gulf of California, México

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Isla San Jorge is a series of small, unvegetated, rocky islands, on which several seabirds have nested: Red-billed Tropicbird (*Phaethon ethers*), Double-crested Cormorant (*Phalacrocorax auritus*), Brandt's Cormorant (*P. penicillatus*), Brown Booby (*Sula leucogaster*), Royal Tern (*Sterna maxima*), Elegant Tern (*S. elegans*), Yellow-footed Gull (*Larus livens*), and Heermann's Gull (*L. heermanni*). Although data are scant, 20th century changes are evident. Terns and gulls ceased to nest between the 1930s and 1991, while Double-crested Cormorants and Brown Boobies appear to have increased. More recently, Double-crested Cormorants have increased twelve-fold since 1991, but Brown Boobies have remained at 2500–3000 pairs. In 1999, Heermann's Gulls resumed nesting on San Jorge, and Brandt's Cormorants were found nesting here for the first time. Human-caused factors have been proposed to explain variations (reductions) in seabird colonies in the Gulf of California, but oceanographic causes seem more likely, although no adequate data exist

to test either hypothesis. ENSO events have induced large numbers of Blue-footed Boobies (*S. nebouxii*) to use the area, but caused the Brown Boobies to interrupt their breeding and leave for the Colorado River delta. San Jorge seems ecologically different from other islands in the Gulf of California, and Brown Boobies have a much longer breeding season here, presumably because of food availability. Whereas Brown Boobies (and other marine amniotes) elsewhere in the Gulf depend on small pelagic fish and leave the islands in their absence, on San Jorge Brown Boobies turn to bottom and reef fishes that are accessible because the surrounding area is shallow.

Solutions to seabirds in Alaska's demersal longline fisheries

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Seabird mortalities occur in longline fisheries as seabirds feed on sinking baits when the gear is deployed. All Alaska longline fisheries face closure or limitation due to the potential hooking mortality of Short-tailed Albatross (*Phoebastria albatrus*), an internationally endangered species, and these fisheries now operate under new regulations borrowed from other nations. In order to develop Alaska-specific solutions to seabird bycatch, we compared seabird and fish catch rates among several seabird deterrent strategies and a control in 1999 and 2000. Our research was done in the Individual Fishing Quota (IFQ) fishery for sablefish (*Anoplopoma fimbria*) in the Gulf of Alaska and Aleutian Islands, and in the Pacific cod (*Gadus macrocephalus*) fishery in the Bering Sea. Based on results from 1999 and collaboration with fishers, deterrents in 2000 included paired streamer lines,

paired streamer lines with weight added to the groundline, and a single streamer line. Paired streamer lines with and without weight on the groundline reduced seabird bycatch rates most effectively in the sablefish fishery (100%) and in the cod fishery (94%), without any decrease in target fish catch rate or increase in the catch rate of non-target species. Single streamers were less effective, reducing seabird bycatch by 96% and 71% in the sablefish and cod fisheries, respectively. Although seabird bycatch rates in control sets varied dramatically on temporal scales in both fisheries and on spatial scales in the sablefish fishery, paired streamer lines were consistently effective. Based on these results, we recommended that paired streamer lines be required in all Alaska longline fisheries to minimize seabird bycatch.

Traveling in uncharted waters: use of seabird data complements traditional information for managing Pacific herring (*Clupea pallasii*) in central California

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Pacific Herring (*Clupea pallasii*), a species of commercial importance in California, is adaptively managed by the California Department of Fish and Game. Information currently used to assess the status of the herring population and establish quotas includes spawning biomass and age composition of the prior season's biomass estimate, as well as information on ocean conditions and young-of-the-year abundance. However, spawning biomass in year "x" may not accurately predict stock size in year "x + 1" if variable oceanographic conditions affect at-sea herring foraging and survival. Seabirds, as indicators of biological production at lower trophic levels, may provide a means of quanti-

fying how oceanographic conditions and variation in prey availability influence the spawning biomass, size-at-age, and body condition of adult (i.e., reproductive) herring. Planktivorous seabirds, such as Cassin's Auklets (*Ptychoramphus aleuticus*), have similar food habits as adult herring while foraging at sea and are highly correlated to herring parameters. In this study, we report how seabird productivity data from Southeast Farallon Island (42 km west of San Francisco Bay) can serve as a basis for understanding spawning biomass and body condition for the San Francisco Bay herring stock in the following winter. Use of this non-traditional information for assessing the feeding conditions for herring at sea can help manage the fishery from an ecological perspective, in accordance with objectives of California's Marine Life Management Act.

An unprecedented breeding failure of Parakeet Auklets at Buldir Island in 2001

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In 2001, Parakeet Auklets (*Aethia psittacula*) experienced an unprecedented complete reproductive failure at Buldir Island, Aleutian Islands, Alaska, and at Talan Island in the northern Sea of Okhotsk, Russia. The Alaska Maritime National Wildlife Refuge has a long-term program to monitor selected species of seabirds that nest on the refuge. Productivity, hatching chronology and food habits of auklets (*Aethia* spp.) have been monitored at Buldir Island annually since 1988. Until 2001, annual productivity (chicks fledged/nest) of planktivorous auklets ranged from 0.38–0.78, with Parakeet Auklet productivity ranging only from 0.50 to 0.65. Interestingly, in 2001 the productivity of all 3 other auklet species (least Auklet [*Aethia pusilla*], crested Auklet [*Aethia cristatella*], and Whiskered Auklet [*Aethia pygmaea*]) remained within previous ranges. We

expected productivity of diving planktivores to be relatively similar and have never observed a complete failure in any planktivore on the refuge. In 2001, 60% of Parakeet Auklet chick loss occurred during a one-week period of sustained gales. We will present two hypotheses to explain chick mortality: (1) physical wave action and wind prevented Parakeet Auklets (but not other diving planktivorous auklets) from feeding young, or (2) auklet species were equally able to feed young, but because Parakeet Auklets hatched later than other species, the young were too small to survive reduced food deliveries. We compared data among sites and among species to elucidate these relationships.

Modeling and managing water-level variation and its effects on the availability of nesting habitat for White Pelicans at Clear Lake National Wildlife Refuge, California

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In California, the largest breeding colony of the American White Pelican (*Pelecanus erythrorhynchos*) is presently located at Clear Lake Reservoir, within the Klamath Basin watershed. In the early 1900s, the Klamath Basin itself was "reclaimed" for irrigation projects. Clear Lake Reservoir was historically a natural lake subject to high seasonal and annual variation in water level, but today it is a major storage reservoir for water, especially important to agriculture during drought periods. Thus, the lake is still subject to high variation in water level. At Clear Lake, the location of specific White Pelican nesting colonies varies with the availability of nesting islands, which in turn are variously affected by water level variations. The timing of island formation and availability is crucial for

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the annual success of breeding pelicans, especially during the stages of nest establishment, egg-laying, and incubation through about 3–4 weeks of chick growth. At this time the colonies are most vulnerable to trampling by cattle and to predation from various mammalian and avian predator species. Water levels at Clear Lake have been monitored by the U.S. Bureau of Reclamation since 1910, and in any given season, monthly water-level projections are available. By combining seasonal water-level predictions and plans with GIS digital maps it is possible to predict precisely when and where suitable nesting islands will form, when they will be connected to the mainland, and when management actions (e.g., protective electrical fences and other barriers) might be appropriate.

At-sea surveys of predators: letting the birds draw the boundaries of marine reserves

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The use of Marine Protected Areas (MPAs) as a partial solution to marine conservation issues, such as the over-exploitation of fisheries resources or areas of unacceptable rates of seabird bycatch, has recently gained widespread acceptance. MPAs not only have the potential to replenish depleted fish stocks, they also may protect pelagic food webs upon which upper trophic level predators depend, as well as the predators themselves. However, there are few time series available to identify the location of these pelagic food web production "hotspots." In this presentation, we investigate whether seabird at-sea distribution can help delineate potential boundaries of future

MPAs. Specifically, we use information on the at-sea distribution of Cassin's Auklets (*Ptychoramphus aleuticus*), Common Murres (*Uria aalge*), Rhinoceros Auklets (*Cerorhinca monocerata*), and Tufted Puffins (*Fratercula cirrhata*) to draw the boundaries of hypothetical MPAs around breeding colonies off the west coast of North America. The objectives of these fictional MPAs are to protect breeding birds from anthropogenic impacts while foraging at sea, and to serve as refugia for the prey stocks from exploitation. Data collected during the breeding season from 1981 through 2001 via ship-of-opportunity surveys are examined in relation to the location of major colonies from Triangle Island (northern Vancouver Island, British Columbia), to Tatoosh Island (Washington), as well as with respect to the location of the continental shelf-break (depth 200 m). Patterns of clustering demonstrate that at-sea seabird surveys may help identify temporally/spatially persistent food web constituents, and may also be useful in drawing broad-scale MPA boundaries to protect breeding seabird populations.

Century-long impacts of increasing human water use on numbers and productivity of American White Pelicans at Pyramid Lake, Nevada

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Anaho Island at Pyramid Lake, Nevada, supports one of the largest breeding colonies of American White Pelicans (*Pelecanus erythrorhynchos*). Counts of adults, nests, and chicks from 1903 to present have been strongly correlated with springtime water in the Truckee River near Nixon, 15 km from the lake (e.g., numbers of pre-fledging chicks ("productivity") vs. mean daily flow, February-May, $r = +0.627$, $n = 43$ years, $P < 0.001$). Up-river diversion of water has markedly reduced flows of the lower Truckee

River and has also likely depressed pelican productivity; e.g., the Derby Dam, completed in 1906, diverts water from the Truckee River into the Truckee Canal. Pelican productivity has been negatively correlated with flows in the Truckee Canal (e.g., productivity vs. March flow, $r = -0.472$, $n = 28$, $P = 0.01$). If water remained in the river instead of being diverted in the canal, estimated productivity would be 7% higher in mean flow conditions and 5% higher in minimum flow conditions. Using a model of estimated natural vs. observed flow rates of the Walker River as a proxy for the Truckee River, we estimated that on average 958 more fledglings would have been produced annually if natural flow regimes still persisted in the Truckee River. Although inferring long-term impacts of such losses on population dynamics is problematic, such productivity could be an important buffer against density-independent, localized high mortality events, such as the die-offs of an estimated 8,500 pelicans at the Salton Sea in 1996 and 1,200 in a hail storm in Colorado last fall (2001).

Common Murre egg recovery on Devil's Slide Rock in central California

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Common Murre (*Uria aalge*) breeding success has been monitored in 1996–2001 at Devil's Slide Rock as part of a restoration project related to the Apex Houston oil spill. In 2001, we recorded a total of 113 breeding pairs, 22 first-egg losses (19.5%), 5 replacement eggs laid after loss of the first egg (22.7%), and 1 replacement-egg loss (20%). Incidentally, two cases of parents recovering eggs that had rolled

away from sites were observed. One egg was retrieved at a distance of 85 cm, whereas the other egg was secured and incubated at 54 cm from the original nesting site. We describe the circumstances surrounding these egg recoveries, including: microhabitats related to eggs rolling away from sites; behavior of parents recovering lost eggs; fate of recovered eggs; and other factors affecting the egg recovery ability of adult murres (i.e., slope, interaction with cormorants).

Kittiwakes on Kodiak Island respond to regime shifts in the Gulf of Alaska

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Climatic and biotic "regime shifts" occur on a decadal time scale in the Gulf of Alaska and Bering Sea and have been implicated in recent declines in population of seabirds and marine mammals in this region. Black-legged kittiwakes (*Rissa tridactyla*) are a good bio-indicator of regime shifts because their diet and breeding success reflects prey abundance. We evaluated the consequences of regime shifts on 26 kittiwake colonies in Chiniak Bay (Kodiak Island, Gulf of Alaska) using data on populations (nest counts) and productivity (chicks fledged/nest attempt) that has been collected since 1975. We extended this time series in 2001 through research on the foraging and reproductive ecology of kittiwakes that was undertaken as one component of the multi-disciplinary Gulf Apex Predator-Prey project (GAP) on Kodiak Island. Overall, kittiwake populations increased in Chiniak Bay during the warm regime of the 1980s and colonization of 15 new breeding sites occurred. Kittiwake abundance decreased during the "mixed" regime of the

1990s, but increased once again after a shift towards cooler conditions in 1998. In contrast to these general patterns, "new" colonies have been more productive than "old" colonies and have grown steadily since their inception in the mid-1980s, through the 1990s, and up to the present. Although we cannot explain why new colonies have outperformed old colonies, inflection points in population trends of old colonies coincide well with proposed regime shifts and indicate good breeding conditions during the 1980s and within the current regime, but suggest that breeding conditions were comparatively poor during the 1990s.

Diet composition of Double-crested Cormorants nesting at East Sand Island in the Columbia River Estuary

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East Sand Island, located at river mile 5 in the Columbia River Estuary, supports the largest known breeding colony of Double-crested Cormorants (*Phalacrocorax auritus*) on the Pacific Coast of North America (Carter et al. 1995). Diet composition of cormorants nesting on East Sand Island in 2000 and 2001 was determined by analysis of stomach contents from collected adults and of regurgitations from nestlings. The composition of cormorant diets varied both within and between breeding seasons, reflecting changes in the abundance and availability of prey. Diets consisted almost entirely of fish, including a variety of riverine, estuarine, and marine fish species. In 2001, cormorants were less dependent on out-migrating juvenile salmonids than

in 2000. However, the prevalence of marine forage fishes—anchovy (*Engraulis mordax*), Pacific tomcod (*Microgadus proximus*), and clupeids (sardines [*Sardinops sagax*], American shad [*Alosa sapidissima*], and Pacific herring [*Clupea pallasii*])—in the diet was higher as compared to 2000. In both 2000 and 2001 the percentage of juvenile salmonids in the diet declined dramatically as the breeding season progressed. In 2000, the seasonal decline in salmonids was compensated for by increasing prevalence of clupeids and pleuronectids (flatfish) in the diet. In 2001, anchovy was overall the most prevalent prey type in cormorant diets, and prevalence increased later in the breeding season when juvenile salmonids were a very small proportion of the diet. The high prevalence of anchovy in the diets of Double-crested Cormorants nesting at East Sand Island is in stark contrast to the late 1990s when herring and juvenile salmonids comprised the bulk of the diet.

Age and sex composition of Common Murres recovered in the 1997-1998 Point Reyes tarball incidents in central California

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Age and sex composition of Common Murres (*Uria aalge*) affected by oil spills are poorly known because of the difficulty in collecting widely distributed carcasses and in storing and examining large numbers of specimens. We examined 1,082 murre carcasses recovered by state and federal agencies during the 1997-1998 Point Reyes tarball incidents in central California. Four variables were used for rapid classification of murre ages as hatching year (HY) or after hatching year (AHY): head plumage, supra-orbital ridge, bursa of Fabricius, and gonad size. Murres were sexed by gonad inspection. Plumage class was de-

terminated in 95.5% of birds examined ($n = 1033$), the extent of ossification of the supra-orbital ridge in 91.7% ($n = 992$), presence or absence of the bursa in 73.9% ($n = 800$), sex in 78.6% ($n = 850$), and gonad size in 74.0% ($n = 801$). Using a combination of two or more variables, we determined that 8.9% of the sample ($n = 1082$) were HY birds and 91.1% were AHY birds. The sex ratio in HY murre was 1.35:1 (male:female; $n = 80$), versus 1.54:1 in AHY murre ($n = 770$). We also characterized geographic and seasonal trends in age and sex composition and examined methods for separating younger from older AHY birds.

A historical perspective on oiled wildlife care in California

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California's Oiled Wildlife Care Network (OWCN) is currently one of the world's leading authorities at treating oil-injured wildlife. However, the reputation California has earned over the past 30 years has evolved due to tremendous efforts of professional rehabilitation organizations such as International Bird Rescue Research Center (IBRRC), changes in legislation, and ultimately, development of an infrastructure within the state that supports rapid spill response and effective wildlife care. It is through integration of oil spill response experience and research advances that California has been able to move ahead as the world leaders in the young science of oil spill medicine. Many advances have been integrated into current spill response techniques; however, there is room for further improvement. This presentation will summarize current response techniques, highlight research and husbandry advances that have improved

oiled wildlife care, and present the future challenges of oil spill medicine in California and worldwide.

Beach COMBERS: detecting oiled seabirds in Monterey Bay

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A beach monitoring study, utilizing volunteers to sample selected sections of beach for dead marine birds and mammals, was established within the Monterey Bay National Marine Sanctuary in February 1997. Nine beaches within Monterey Bay and one beach in Carmel Bay have been monitored monthly since May 1997. A stretch of sandy beach along the outer coast north of Santa Cruz has been monitored since September 1998. In May 2001, six new beach segments at the southern end of the Sanctuary were added. The primary goal of the program, designated Beach COMBERS (Coastal Ocean Mammal/Bird Education and Research Surveys), is to obtain information on rates of stranding for all species of marine birds and mammals in Monterey Bay. The long-term objectives of the program are to provide a baseline of information on the average presence of beachcast marine organisms and to assist the Sanctuary in the early detection of mortality events triggered by natural and anthropogenic environmental perturbations such as red tides and oil spills. Pairs of trained volunteers survey their beach segment during the first week of each month at low tide. Beachcast seabirds are the most abundant organisms encountered during any beach survey. Average seabird deposition is greatest and most variable during the spring and summer months, and least during the winter months. Over the past 4 years, there have been very few incidents of oiled birds found on surveyed beaches.

Increase of body core temperature but decrease of body peripheral temperature in diving Thick-billed Murres

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Many diving seabirds and marine mammals frequently dive longer than calculated aerobic diving limits. From the view of their diving behavior and efficiency, however, it is a convincing concept that they do not accumulate anaerobic by-products in most dives. Recent studies suggest that reduction in body temperature in deep-diving penguins and cormorants could enable them to decrease metabolic rate and hence make long aerobic dives. Alcids make longer dives than penguins after adjustment for body size. Therefore, alcids may have such a mechanism for sparing oxygen. In this study, body core and peripheral temperatures and diving depth of Thick-billed Murres (*Uria lomvia*) were measured by using implanted data loggers while they were freely diving in cold water (ca. 0°C) in Svalbard, Norway. Body temperature of the core region (under the liver) increased, but that of peripheral region (between the skin and muscle at abdomen) decreased when birds engaged deep and long dives. When they came back to the surface, the core temperature decreased and the peripheral temperature increased. As a result, they lost body temperature while they repeated dives for more than a half-hour. These results indicate that Thick-billed Murres can control their blood flow in order to supply oxygen to energy-demanding organs for diving behavior.

The epizootiology of type C botulism in pelicans at the Salton Sea

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In recent years, the Salton Sea has been the site of massive mortality events involving both fish and fish-eating birds. During 1996, type C avian botulism was the cause of death of nearly 15,000 birds. Over half of the dead birds were western White Pelicans (*Pelecanus erythrorhynchos*), and close to 1200 were endangered California Brown Pelicans (*Pelecanus occidentalis californicus*). Smaller botulism die-offs have occurred every year thereafter. Fish in the Salton Sea are the suspected source of type C toxin. In 2000 and 2001, tilapia (*Oreochromis mossambicus*) were collected at various sites around the Salton Sea in order to determine the presence of type C botulinum toxin in their blood and intestines, and to determine the presence of the *Clostridium botulinum* type C organism in their intestines. This information, in conjunction with spatial data obtained from collecting sick and dead pelicans, will provide insight into the dynamics of this unique disease system.

Plasma testosterone levels in breeding Leach's Storm-Petrels

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Leach's Storm-Petrels (*Oceanodroma leucorhoa*) are socially and genetically monogamous seabirds in which the male shares incubation of the single egg equally with the female. We predicted that testosterone levels in males would be elevated during courtship, then decline rapidly during incubation. Testosterone is negatively correlated with incubation behavior in many birds, typically remaining ele-

vated in males that do not incubate eggs. In polygynous species, males exhibit elevated testosterone levels until opportunities to fertilize eggs are exhausted. We obtained blood samples for direct radioimmunoassay of pooled androgens, testosterone, and dihydrotestosterone during the summers of 1998 and 1999 at Kent Island, New Brunswick. Although testosterone and dihydrotestosterone levels in male Leach's Storm-Petrels declined as the breeding season progressed, the difference between samples taken during courtship stage and the first two weeks of incubation was not significantly different (courtship: 3.86 ng/ml; early incubation: 1.95 ng/ml; $P = 0.136$; 1999). When regressed against the specific date of incubation relative to egg hatch, the decline in males' androgen levels was marginally significant ($P = 0.051$, $r^2 = 0.14$; 1998). Our results did not follow our prediction entirely. Although androgen levels dropped precipitously during early incubation in some males, they remained elevated through late incubation in other males. Arrival, egg-laying, and subsequent hatching dates are asynchronous in this population of Leach's Storm-Petrels. Egg hatching dates range between 29 June and 11 September. Males may continue secreting testosterone at modest levels (1–2 ng/ml) to enable them to fertilize a replacement egg should the first one fail.

Parasites of the American White Pelican

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About 15 species of parasites have been reported from the American White Pelican (*Pelecanus erythrorhynchos*). However, based on at least eight unreported records from Mississippi and Louisiana and the much higher number of species already found in the Brown Pelican (*Pelecanus occidentalis*) from the same general region, many more species probably also infect the White Pelican. Parasites typically

do not harm their hosts, and those from the White Pelican typically fit that category. However, a few, including the pouch louse and a hippoboscid fly, can weaken or kill the pelican host. Such a situation often develops in nestlings and in stressed birds or captives, especially young individuals. Other parasites such as two trematodes (flukes) that mature in the White Pelican have a juvenile stage in catfish that can harm or kill the fish host when confined in commercial ponds. Therefore, based on the loss of catfish from pelican predation and infections from the pelican worms, White Pelican parasites might create an economic aversion in fish farmers toward the pelican. Further, some flukes that infect the pelican can also mature in humans and result in disease: a juvenile nematode that matures in the pelican can probably cause a strong response in a human host. Perhaps microbial agents harbored by some parasites of the pelican can also pose a public health risk to those who handle the parasite host.

Most parasites of the White Pelican (e.g., the helminth species consisting of flukes, roundworms, tapeworms, and spiny-headed worms) are beneficial in that they can provide information about the host, and some may possibly benefit the pelican in some physiological functions. The helminths, many of which are not highly specific to the White Pelican but have intermediate hosts in their life histories, can provide information on where the bird has been and on what prey it has been eating. Perhaps a complex of ascaridoid nematode species helps digest food. The lice are specific to the White Pelican, providing evolutionary information about the relationships with other pelicans and with other bird groups. The presence of all White Pelican parasites usually depends on where the individual nests, rests, feeds, and migrates.

Status of the Humboldt Penguin population (*Spheniscus humboldti*) in Peru during 1999-2000

ABSTRACTS

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The status of the endangered Humboldt penguin (*Spheniscus humboldti*) was investigated in Peru during 1999–2000 after the strongest El Niño event of the last century. The penguin population in the south-central coast of Peru was estimated at 3980 and 4890 individuals in 1999 and 2000 respectively. In 1999, the proportion of juveniles was lower (0.2%) than in 2000 (7%), probably as a result of the 1997–1998 El Niño. Even though penguins were found from Isla La Foca (5° 12' S) to Punta Coles (17° 42' S), the majority (78%, 79%) were located in five localities: Punta San Juan (41%, 36%), San Juanito Islet (13%, 11%), Hornillos Island (13%, 10%), Pachacamac Island (6%, 12%), and Tres Puertas (6%, 9%). The size and distribution of penguin colonies have changed over the last 15 years. Penguins have abandoned places (Punta Corio, Sombrierillo, Morro Sama), or have decreased significantly in numbers in areas (Punta San Fernando and Punta La Chira), where human disturbance has increased, mainly due to fishery activities. Penguins have increased in numbers (Punta San Juan, San Juanito Islet) in areas with some kind of protection. Half of the penguin population was located in guano-bird reserves, mainly at Punta San Juan. Guano-bird reserves provide penguins with indirect protection against predators and human disturbance; however, periodic guano harvests affect their reproductive success. It will be mandatory to promote collaborative conservation efforts between local authorities and biologists to minimize

negative effects of guano harvests, to initiate educational programs in fishing villages, and to reduce penguin mortality in gill nets.

An assessment of botulism-stricken American White Pelicans on the Salton Sea, California

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The Salton Sea is California's largest inland body of water, with a surface area of more than 800 km². It is located in the Colorado Desert of southeastern California. The level of the Salton Sea is sustained primarily by agricultural runoff. It has no outlet for water other than evaporation; the closed nature of the Salton Sea, source of water, and climate combine to create a eutrophic, hypersaline system. Since 1996, American White Pelicans (*Pelecanus erythrorhynchos*) and endangered California Brown Pelicans (*Pelecanus occidentalis californicus*) have been sickened by avian botulism (*Clostridium botulinum*) at the Salton Sea. Botulism outbreaks occur from May to November each year with varying degrees of severity. As part of a multi-agency disease response program, botulism-stricken pelicans from the Salton Sea are retrieved and rehabilitated. Locations of sick and dead American White Pelicans were recorded using GIS from May to November 2001. These distributions were plotted and compared to the relative distribution of healthy pelicans at the Salton Sea. Physiological characteristics and rehabilitation success ratios for pelicans retrieved from 1999 to 2001 are presented.

Spatial and temporal distribution of American White Pelicans of the Salton Sea, California

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The Salton Sea is California's largest inland body of water, approximately 56 km long and 24 km wide. Located in the Colorado Desert of southern California, the sea was formed during 1905–1907 when Colorado River floodwaters breached an irrigation structure and redirected the river's flow into the Salton Trough until the breach was closed. The sea's surface elevation is maintained primarily by three rivers, the New, Alamo, and Whitewater, and by agricultural drain water from the Mexicali, Imperial, and Coachella Valleys. Millions of birds use the Sea and surrounding area during annual migrations. More than 400 species of birds have been observed within this ecosystem, making it one of the focal areas for avian biodiversity. Peak populations of 15,000–28,000 American White Pelicans (*Pelecanus erythrorhynchos*) are found at the Salton Sea. From January 2000 through November 2001, American White Pelicans were counted at points around the Salton Sea. Pelican sightings were noted at 26–30 specific shoreline sites. Each site was visited at least twice per month. Data collected included the date, site location, and the estimated number of pelicans. From January 2000 through November 2001, American White Pelicans had a continual presence on the Salton Sea. The number of pelicans peaked twice each year, with the largest peak in February and a second, smaller peak in September. The largest concentrations of pelicans were observed on the Alamo, New, and Whitewater River deltas.

Differential response of murre and kittiwakes to fluctuations in prey density

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While one group of biologists measured the composition, abundance,

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and distribution of forage fish around 3 seabird colonies in Cook Inlet during 5 years (1995-1999), another group measured parameters of biology, behavior, and physiology in Common Murres (*Uria aalge*) and Black-legged Kittiwakes (*Rissa tridactyla*) at the 3 colonies. I will describe some of the main findings of these investigations, and highlight the differential responses of the 2 seabird species to changes in prey density. Murres and kittiwakes are adapted quite differently for dealing with fluctuations in prey abundance; important differences include body size, foraging mode, clutch size and chick development. Kittiwakes always appear to be working maximally and have little discretionary time to compensate for declining prey density. Variability in prey abundance translated directly ($r^2 = 0.89$) into variation in fledging success. Murre breeding success can be buffered by reallocation of discretionary time and was a very poor indicator of food supply, whereas 'loafing time' better reflected ($r^2 = 0.65$) prey density. As predicted by life history theory, both murres and kittiwakes minimized variability in their own body condition ($CV < 10\%$), and in growth of chicks ($CV < 25\%$) in the face of high variability in prey abundance ($CV = 80\%$ among 15 colony-years). Both species exhibited moderate variability ($CV = 25-40\%$) in laying and hatching success, and in foraging effort. Variability in kittiwake breeding success ($CV = 87\%$) tracked prey variability, while murre breeding success did not ($CV = 29\%$). This may explain why murre breeding success in the Pacific is consistently high ($CV = 41\%$), whereas kittiwakes are much more variable ($CV = 110\%$). Implications of these differing strategies will be discussed.

Population status, foods, and foraging of Laysan Albatrosses nesting on Guadalupe Island, Mexico

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During the 1983-84 winter breeding season, Laysan Albatrosses (*Phoebastria immutabilis*) bred in the eastern Pacific for the first time, on Guadalupe Island, Mexico. That population was last censused in 1991-92, when 45 pairs were present, and there are no previous reports on the diet of any of the eastern Pacific populations. We conducted censuses during the 1999-2000 and 2000-01 seasons and collected chick regurgitation pellets for analysis of diet. In addition to the previously known colony on the main island, we found albatrosses breeding at three new locations: on two offshore islets and at another site on the main island. We estimated that the entire population consisted of a minimum of 119 and 193 pairs, respectively, for the two seasons. Although colonies on the main island may not persist in the face of ongoing predation pressure by feral cats, dogs and humans, the offshore islets are predator-free and those populations should continue to grow. The prey we identified included beaks from a minimum of 964 individual cephalopods representing a minimum of 14 families and 23 species. The most commonly identified species were the squids *Histioteuthis hoylei* (20.4% of identified beaks), *Taonius borealis* (13.8%), *Gonatus californiensis* (11.2%), and *Galiteuthis* sp. (most likely *G. pacifica*) (11.0%), respectively. The preponderance of neutrally buoyant, mid-water species of squids in the diet, along with recently published results indicating that Laysan Albatrosses feed mainly during the daytime, is cited as evidence that this species probably feeds mainly as a diurnal scavenger.

Urban lighting and the decline of Kauai seabirds: identifying sufficient offsets to human-induced mortality

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The combination of artificial lighting and increased automobile traffic on oceanic islands invariably leads to a decline in seabird populations. The mechanism for this is simple: birds are attracted to and disoriented by urban lights and fall onto roadways where they are struck by passing cars. One of the more dramatic examples of this is on the island of Kauai, where Newell's Shearwater (*Puffinus auricularis newellii*) and Hawaiian Petrel (*Pterodroma phaeopygia sandwichensis*) are estimated conservatively to have declined to a small fraction of their pre-development levels. A community-wide salvage program called Save Our Shearwaters (SOS) has done much over the last 30 years to ameliorate this human-induced mortality, as has a program to install shielded lighting around the island. However, these efforts do not provide a sufficient offset to the mortality to insure the survival of these two populations. Rather, it will require a commitment to a far more ambitious and proactive conservation program.

Bridge to the 21st century and cormorants will be on it

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Early in 2002, construction will begin on a new bridge to replace the seismically vulnerable east span of the San Francisco-Oakland Bay Bridge. When the old span is taken down, so will be the homes of close to a thousand Double-crested Cormorants (*Phalacrocorax auritus*) that nest on beams underneath it. In an effort to preserve the habitat of the Double-

crested Cormorant population, Marine Endeavors was consulted by the California Department of Transportation (CalTrans) and the joint-venture design team of T.Y. Lin International of San Francisco and Moffatt & Nichol Engineers of Long Beach to design a possible solution. After investigating how best to mimic existing habitat, approximately 670 m² of stainless steel nesting platforms and a roost rail were designed on the new 3.8-km long replacement span. Placement of the structures will be in the same approximate location as they are now, in order to take advantage of a post-fledging roost site off the bridge. If the birds do not relocate independently, biologists plan to entice the birds to nest on the new platforms by painting cormorant silhouettes, playing recordings of cormorants at a colony, and/or placing mirrors on the platforms. Placed underneath the new span on the inside edges of the roadway, the platforms will be invisible to motorists on the bridge. The Skyway construction is expected to commence in early 2002, and the cormorant platforms will be the last object placed on the bridge in late 2006.

White belly and black back—what are the causes of seabird color patterns?

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Textbooks tell us that the function of a black back and a white belly in many seabirds is to camouflage the bird against potential prey and predators. Although intuitively obvious, this hypothesis has numerous exceptions in almost all major clades of seabirds, which raises doubt about its validity. To test this and alternative hypotheses, we apply a phylogenetic approach using published data. Penguins and alcid are more extremely adapted to an underwater lifestyle than any other birds and are therefore preferred model organisms. While there is some variation

in the exact black-and-white distribution, essentially all penguins are white underneath and dark above. Many alcid species on the other hand display black bellies, at least during the breeding season. Mapping belly coloration on a phylogenetic tree shows that this character must have changed at least four times independently during the evolution of alcids. Using 339 seabird species, we explore alternatives to the camouflage hypothesis, including melanin as a protector against UV radiation, sexual selection for a handicap, and the null hypothesis that plumage coloration is a physiological byproduct rather than a selected trait.

Changing regulations in Alaska's longline fisheries—an example of regional implementation of the United States' National Plan of Action for seabirds

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The National Marine Fisheries Service (NMFS) is revising the existing federal seabird avoidance regulations in Alaska, based on results from a two-year scientific research program conducted by the Washington Sea Grant Program (WSGP) on the effectiveness of seabird avoidance measures currently used in the longline fisheries off Alaska. There are concerns relating to the incidental catch of the endangered Short-tailed Albatross (*Phoebastria albatrus*) and other seabird species. A Biological Opinion issued by the U.S. Fish & Wildlife Service (USFWS) in 1999 required that NMFS investigate the effectiveness of seabird avoidance measures currently used in Alaska's longline groundfish fishery and revise those measures if necessary. WSGP recommended regulatory changes that would include: use of paired streamer

lines, specified performance and materials standards for the lines, and prohibition of directed discharge of offal or residual bait from the stern of the vessel while fishing gear is being deployed. Revisions to regulations will also include some modifications for small fishing vessels and their use of seabird avoidance measures. Besides regulations, other critical aspects of a comprehensive seabird bycatch reduction program are necessary to effectively reduce seabird bycatch. Examples include outreach materials, education, and working one-on-one with high-bycatch vessels. There has been collaboration between NMFS, USFWS, WSGP, the Pacific States Marine Fisheries Commission, the North Pacific Fishery Management Council, numerous longline industry groups and individuals, environmental groups, and others.

This action represents an example of regional implementation of the US's "National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries," which was finalized in February 2001.

Morphological differences in the flight and feeding apparatuses of four sympatric species of terns breeding in southern California

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In an effort to further understand the feeding ecology of four sympatric species of terns breeding in southern California, we looked for morphological differences in their flight and feeding apparatuses. Using a multivariate approach, we measured several variables on the disarticulated skeletons of each species. We found that differences in morphology were mostly due to three variables describing wing shape. Elegant Terns (*Sterna elegans*) have the longest wing components relative to body length compared to the other three species. The ratios of component length to body length were intermedi-

ate for all wing components in Caspian and Forster's Terns (*S. caspia* and *S. forsteri*), with Forster's Terns having a larger ratio for length of phalanges to body length than Caspian Terns. The ratio for length of phalanges to body length in Forster's Terns was similar to that in Elegant Terns. Least Terns (*S. antillarum*) had the lowest values for all wing components relative to body length. Although there were significant differences in the ratios of bill length to body length and width of gape to body length, these variables did not play an important role in distinguishing the morphologies of the four species. There was no significant difference in the ratio of bill depth to body length. The strong influence of wing shape on morphological differences among the four tern species suggests that foraging behavior plays an important role in distinguishing their feeding ecology. Differences in foraging behavior include distance traveled from the colony and possibly mode of prey capture.

Effects of colony relocation on diet and productivity of Caspian Terns in the Columbia River estuary

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In 2001, all Caspian Terns (*Sterna caspia*) nesting in the Columbia River estuary, or anywhere else along the coast of the Pacific Northwest, used 3.9 acres of restored habitat on East Sand Island. The estimated size of the East Sand Island colony (9100 pairs), the largest of its kind in the world, was not significantly different from 2000, suggesting that the population is no longer

increasing. Tern nesting success at the East Sand Island colony in 2001 (1.3 young raised per nesting pair) was the highest ever recorded for Caspian Terns nesting in the Columbia River estuary, apparently a reflection of high forage fish availability. The proportion of juvenile salmonids (*Oncorhynchus* spp.) in the diet (33%) was the lowest ever recorded for terns nesting in the estuary. This resulted in another decline in consumption of juvenile salmonids by terns in the Columbia River estuary; consumption in 2001 was estimated at 5.9 million smolts (95% CI = 4.8 to 7.0 million smolts). This represents a reduction in smolt consumption by terns of about 5.9 million (50%) compared to the 1999 consumption estimate. To achieve further reductions in annual consumption by Caspian Terns in the Columbia River estuary of juvenile salmonids that are listed under the Endangered Species Act, regional resource managers are considering the restoration of tern colonies outside the estuary and the relocation of a portion of the East Sand Island colony to these alternative sites. The best prospects for restoration or augmentation of Caspian Tern colonies seem to be on the coast of the Pacific Northwest.

The impact of disease in White Pelicans

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Diagnostic records at the National Wildlife Health Center since 1980 indicate that type C botulism (*Clostridium botulinum*) is a major cause of mortality in American White Pelicans (*Pelecanus erythrorhynchos*), with the largest number of events reported and the greatest estimated losses. In 1996, over 15,000 western White Pelicans were estimated to have died from type C botulism at the Salton Sea in California. This was the largest documented die-off of any pelican species and was estimated to represent 15–20%

of the western American White Pelican population. This event was also notable in that it was the first time that fish, specifically tilapia (*Oreochromis mossambicus*), were implicated as the source of toxin for birds. Botulism has recurred in White Pelicans at the Salton Sea every year since, although the magnitude of mortality is much lower. Other significant causes of mortality in White Pelicans include Newcastle disease, trauma, and emaciation of unknown etiology.

The importance of beached bird surveys to detect chronic oil pollution

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The Gulf of the Farallones National Marine Sanctuary and the Farallones Marine Sanctuary Association conduct bi-monthly shoreline surveys along the northern California coast, generating a baseline database that permits temporal analysis of mortality events. Data collected quantifies birds, tarballs, and oiled birds by determining encounter rates (number/km). Data include rates for oiled and unoled Common Murres (*Uria aalge*), Northern Fulmars (*Fulmarus glacialis*), *Aechmophorus* grebes, all bird species inclusive, and tarball deposition. Encounter rates vary annually and seasonally. Murres are consistently the most frequently encountered beached bird and oiled beached bird. Northern Fulmars and *Aechmophorus* grebes are also commonly encountered oiled birds. Beached murres are found most frequently post-breeding, during August–October. Oiled murres, other oiled birds, and tarballs are found most frequently November–February. Data are also collected from carcasses regarding state of decomposition, signs of scavenging, and the level of oiling. This information helps damage assessment modelers to estimate loss rate

of birds killed in an oil spill by comparing baseline values with spill values. Baseline scavenging rates help establish removal rates of carcasses by humans and predators, providing a correction factor for underestimates of the actual numbers of birds from raw counts in the baseline or oil spill databases. It is also important to estimate length of time a carcass has been on the beach in order to determine if it has been oiled post-mortem and therefore should not be counted as a spill victim. Unusual mortality events, such as oil spills, can thus be seen against seasonal baseline trends.

Vulnerability of juvenile salmonids to piscivorous waterbirds nesting in the Columbia River estuary, 1998 to 2000

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Caspian Terns (*Sterna caspia*) and Double-crested Cormorants (*Phalacrocorax auritus*) nesting on dredge spoil islands in the Columbia River estuary prey upon millions of emigrating juvenile salmonids (*Oncorhynchus* spp.) annually. To evaluate the relative vulnerability of various salmonid stocks, we analyzed detections on these colonies of passive integrated transponder (PIT) tags previously implanted in juvenile salmonids; 96,382 tags were detected from the 1998 to 2000 migration years. These tags accounted for 11.5, 4.6, and 2.6% of detections at Bonneville Dam (the last downstream impoundment) for steelhead (*O. mykiss*), coho (*O. kisutch*), and yearling chinook (*O. tshawytscha*) salmon, respectively. When we separated the analysis by bird species, we found that this pattern persisted for terns but not for cormorants. Steelhead and coho salmon were equally vulnerable to cormorants, though both were more

vulnerable than yearling Chinook salmon. When we analyzed detection rates based on rearing history (hatchery vs. wild), we found that steelhead were detected at similar rates, regardless of rearing history, on both tern and cormorant colonies. In contrast, the vulnerability of hatchery yearling Chinook salmon was greater than that of their wild cohorts: for both bird species, tags from 3.2% of hatchery and only 1.5% of wild yearling chinook previously detected at Bonneville Dam were detected on nesting colonies. However, this greater vulnerability was more pronounced on the tern colonies. Finally, when we compared detection rates based on migration history (barged vs. in-river), we found similar rates, with a slightly greater vulnerability of in-river migrants to cormorants.

Putting together pieces: towards a foraging model for Brandt's Cormorants in San Francisco Bay

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Brandt's Cormorants (*Phalacrocorax penicillatus*) colonized Alcatraz Island in San Francisco Bay in 1991. This estuarine colony grew to over 380 pairs in 2001 and maintains a higher average productivity than the neighboring offshore population on the Farallon Islands. In 2000, we began an investigation of cormorant foraging ecology in an effort to understand habitat use and prey consumption of this unique population. Observations of cormorant feeding flocks in 2000 and 2001 showed differences in habitat associations and numbers of birds feeding in San Francisco Bay. In both years, cormorants preferred foraging north of Alcatraz where bathymetry indicates greater slope. In both years, there was decrease in flocking activity after peak chick hatch. In order to better understand this change in foraging behavior during chick rearing, we at-

tached radio transmitters to eight individuals feeding chicks on Alcatraz in 2001. Radio telemetry results indicate that Brandt's Cormorant parents on Alcatraz forage almost exclusively within the estuary and Golden Gate Channel, rather than flying to coastal or pelagic feeding locations. This foraging behavior shift may reflect changing energy requirements as chicks are reared, a seasonal change in prey availability or choice, or some combination of these factors.

Seabird conservation opportunities on the Baja California Pacific islands

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The Baja California Pacific Islands (BCPI) support a diverse and abundant marine avifauna including at least twenty distinct taxa (17 species) and 7 endemic species or subspecies. In comparison, 13 species of seabirds breed in the California Channel Islands and total breeding populations of all species combined are at least two orders of magnitude smaller than those on the BCPI. Agencies and non-governmental organizations that want to protect these seabirds can be most effective by investing their limited resources where they will yield the largest conservation return, regardless of national jurisdiction. Because all but two of the 13 seabirds that breed in the Channel Islands also breed on the BCPI, conservation dollars spent in Mexico will protect many of the same species. In addition, dollars spent in Mexico often lead to proportionately greater conservation benefit. Unfortunately, one of the BCPI seabirds, the

Guadalupe Storm-Petrel (*Oceanodroma macrodactyla*), is already extinct, and others are at risk. Development projects such as rock, seaweed, and guano collection, communication and navigation infrastructure, and proposed projects such as the Escalera Nautica are all potential threats to the BCPI. Proactive efforts to manage and protect the BCPI are needed before further development activities threaten seabird colonies.

The endangered cui-ui: an overlooked prey of American White Pelicans at Pyramid Lake, Nevada

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As a means of measuring pelican predation on cui-ui (*Chasmistes cujus*) spawners, we tracked survival on the cui-ui's attempted spawning migrations up the lower Truckee River and through a gauntlet of waiting American White Pelicans (*Pelecanus erythrorhynchos*). Size range and age structure of cui-ui taken was determined through the recovery of anchor tags and opercle bones from the pelicans' Anaho Island nesting location. We found that, given sufficient stream flow to attract cui-ui to the lower Truckee River, they were a major springtime contribution to White Pelican diet, and that these birds preyed upon a wide range of adult cui-ui sizes and ages. Cui-ui has been an overlooked White Pelican forage resource because of its seasonality, and its lack of availability in some years due to insufficient springtime flow to attract it into the lower Truckee River system. This study gives insight into the historic importance of cui-ui to the Pyramid Lake population of White Pelican diet prior to low springtime flows associated with water diversion from the Truckee River, and also provides information to resource managers who can influence Truckee River flows for the benefit of fish and wildlife.

Foraging effort in relation to the constraints of reproduction in free-ranging albatrosses

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Theoretical models predict that breeding animals will vary their effort to maximize different currencies such as time and energy when the constraints of reproduction change over the course of a breeding cycle. However, this is poorly studied in free-ranging animals. Therefore we compared mass changes, foraging costs and efficiency, and activity-specific behaviors of Wandering Albatrosses (*Diomedea exulans*) during the incubation and chick-brooding stages of 1998 on the Crozet Archipelago. Thirty-eight albatrosses (20 during incubation and 18 during brooding) were injected with doubly-labeled water and equipped with satellite transmitters and activity data loggers. Although albatrosses traveled 3.7 times farther and were at sea 3.2 times longer during the incubation stage, foraging costs were significantly higher during the brooding stage (brooding cost 4.98 ± 0.55 W kg⁻¹ vs. incubation cost 4.52 ± 0.50 W kg⁻¹; mean \pm SD, W = watts). The rate of daily mass gain significantly decreased with time at sea during the incubation stage, whereas the rate of daily mass gain significantly increased with time at sea during the brooding stage. Overall, foraging effort (energy per unit time) was higher during brooding, suggesting that birds were minimizing time at sea to maximize the rate of food delivery to chicks. In contrast, foraging effort was lower during incubation, which had a positive effect on foraging efficiency (energy gain per energy expended). In light of our ability to measure foraging effort during incubation and brooding, we estimate that total breeding cost for a Wander-

ing Albatross pair is equivalent to 2750 MJ, a 61% increase over previous estimates.

Timing of breeding in Common Murres and Black-legged Kittiwakes in relation to variation in oceanographic conditions and food supply

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We examined the relationship between seasonal and annual variation in oceanographic conditions and food supply on the timing of breeding and reproductive success in Common Murres (*Uria aalge*) and Black-legged Kittiwakes (*Rissa tridactyla*), at breeding colonies in Lower Cook Inlet, Alaska, from 1995 to 2000. Intra-colony lay date differed significantly among years for each species. Lay date and laying dispersion (variance, skewness, and kurtosis) differed between species within seasons. Lay date and laying dispersion were negatively correlated with reproductive success. Food supply (forage fish abundance) and sea-surface temperature increased as the season progressed. For both species, lay date and laying dispersion were significantly related to sea-surface temperature and food supply during the pre-lay period (the first half of June for kittiwakes and the first half of July for murres) but there was no significant relationship with food supply or sea-surface temperature at any other time in the season. The negative correlation between food supply and lay date suggest that annual variability in laying is due to physiological constraints associated with food limitation. Transient and relatively small-scale fluctuations in ocean temperature that alter local food availability may ultimately have large impacts on reproductive success. These results demonstrate that very small shifts in climate can have potentially dramatic effects on seabird populations.

Things we like: penguin preferences of humans and implications for conservation

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The fate of many of the world's species will be decided by humans. Therefore, human values will be important determinants of many species' prospects for survival. This study investigates human preferences among the penguins. Human preference was inferred from the representation of different types of penguins in comprehensive, large-format photograph books on penguins designed for the general public. From all such books published and widely distributed in the last five years, all photographs were evaluated for size and subject. The 17 species of penguins were classified into eight "morphospecies" that can easily be visually distinguished by lay readers. Rankings of morphospecies, both by number of photographs and total page area, was highly concordant among the books, suggesting commonly held preferences among humans. In all books, King/Emperor penguins (*Aptenodytes* spp.) ranked highest, and Yellow-eyed (*Megadyptes antipodes*) and/or Little (*Eudyptula minor*) ranked lowest. Gentoo (*Pygoscelis papua*) and Crested (*Eudyptes* spp.) penguins ranked high in all books, and *Spheniscus* penguins ranked low. Few of the photographs depicted penguins in the water. Color was an important determinant of preference; size and neotenic form, traits proposed by other authors as determinants of human preferences for animals, were not important. Of particular concern for conservation, some of the most imperiled penguins were least represented. Human preferences are difficult to assess and these results must be interpreted cautiously. Nonetheless, given their likely importance in decisions about species protection, we must attempt to understand human preferences and incorporate that under-

standing into our efforts to conserve biodiversity.

Decline of the Marbled Murrelet population on the central Oregon coast during the 1990s

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Standardized surveys for Marbled Murrelet (*Brachyramphus marmoratus*) abundance and distribution at sea from 1992 to 1999 were analyzed using 100-m strip transects for a 106-km portion of the central Oregon coast, Siletz River to Siuslaw River. Densities showed a significant drop beginning in 1996, with no increase thereafter. Densities decreased in both near shore and offshore strata within 3 km of shore. Population estimates decreased from roughly 10,500 to 4100 birds in the area from the early to the late 1990s. There may have been a decrease in abundance in southern Oregon, but there was no evidence of a decline in northern Oregon. Removal of nesting habitat during the 1980s and low overwinter survival associated with decreased marine productivity are possible factors contributing to the decline.

Prey abundance and breeding success of the Black-legged Kittiwake (*Rissa tridactyla*), it was not that simple: a five-year ecosystem study

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As part of the Alaska Predator Ecosystem Experiment (APEX), we

studied the mechanisms of food limitation for kittiwakes breeding at three colonies in Prince William Sound, Alaska, during 1995 to 1999. Overall, breeding conditions exhibited extensive regional, inter- and intra-annual variation and were not consistently better or worse at any one colony in all years. Variation in median hatch date, clutch size, and laying success was not linked to environmental variables (ranging from sea surface temperature to zooplankton and forage fish abundance; $r^2 < 0.182$, $P > 0.21$, $n = 10$). This indicated that factors affecting early season nesting conditions were complex and not sufficiently described by our suite of selected variables. Hatching success, on the other hand, was strongly linked to colony size, incubation foraging trip duration, and adult body condition ($r^2 = 0.78$, $P < 0.03$, $n = 9$). Likewise, indicators of chick-rearing conditions, such as beta chick survival, and growth rates were most strongly affected ($r^2 > 0.70$, $P < 0.05$, $n = 9$) by chick-rearing foraging trip duration, percent mass of 1-yr-old herring consumed (beta survival only) and total prey abundance (growth rates only). Decreasing foraging trip duration, thereby increasing nestling provisioning rate, was a key factor in nestling development and varied with prey type in addition to prey abundance. Overall, breeding success (nestlings/pair) showed little relationship to total prey abundance, likely due to confounding factors of colony size, location, and differential effects of predation of eggs and chicks. However, the largest colony, which was relatively least affected by predation, did show a strong, asymptotic relationship to 1-year-old herring abundance.

Time-series analysis of seabird data: application to assessing ecosystem change

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Ecosystem management is dependent upon establishing the frequency and amplitude of environmental fluctuations. Arguably, time-series analyses are likely to produce some of the most robust information concerning when and why environmental fluctuations occur. As an example, we applied spectral and wavelet analysis to a 30-year time-series, 1971–2000, on the reproductive performance of seabirds in the southern California Current marine ecosystem to investigate patterns of environmental change at multiple time scales. We tested the hypothesis that distinct patterns of response (in reproductive performance) could be modeled in relation to known environmental fluctuations, such as El Niño and the Pacific Decadal Oscillation. Initially, we tested for a trend in the data, and after removal of a trend (if one existed), examined the frequency spectra for known patterns of ecosystem variability. For Pigeon Guillemot (*Cephus columba*), a species with relatively high foraging costs during reproduction, we found a significant negative trend in the data, which appeared to reverse in recent years. Maximum entropy spectral analysis revealed 2-year and 4-year periodicities in the data; the quasi-4-year periodicity appears to be associated with (and explained by) the frequency of El Niño events. We also applied spectral analysis to environmental indices (Southern and Northern Oscillation Indices, Multivariate El Niño Index, Pacific Decadal Oscillation) to test for cross-correlation and lagged responses with the guillemot data. Winter measurements of these indices were most strongly correlated with guillemot reproductive performance; this is reflective of environmental conditions that determine prey availability during the breeding season. A 13-year periodicity was evident in the winter NOI dataset. Wavelet analysis indicated that periodicity in the guillemot productivity dataset changed in the mid-1970s (from a biannual pe-

riod) and mid-1980 (to a 4-year period). However, these periodicities ended in the mid 1990s, suggesting either limitations in the dataset to detect periods, or a new environmental fluctuation at that time. Seabird data may be useful for pinpointing when major environmental/ecosystem changes occur, and how patterns of change fluctuate through time. Such information can be valuable for understanding change in other biological populations.

A constituency for the American White Pelican: the role of the nature writer in science and conservation

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Through nature writing, photography, and the experience of hands-on fieldwork, I present the nature writer as a key link in the conservation of the American White Pelican (*Pelecanus erythrorhynchos*). As a nature writer in Nevada, my audiences include the general reader, the federal government, the Pyramid Lake Paiute Tribal Council, and the scientific community. Through my involvement in a critical aspect of Nevada's natural history—the seasonal nesting of the American White Pelican—I integrate scientific knowledge with stories about the research process and the difficult work of doing science while not neglecting responsibilities to conservation. People rarely act on behalf of species they know little or nothing about. The job of the nature writer is to integrate accurate scientific information with lyrical prose to provide a liaison between scientist and layperson. The nature writer serves as translator, educator and storyteller. The critical role played by the nature writer is to engage diverse audiences in conversations about the importance of biodiversity in their own communities. While observing pelican nesting behavior on Anaho Island, located in Pyramid Lake approximately thirty-five miles northeast of Reno, Nevada, I

witnessed social and political unrest surrounding federal allocation of water resources to Pyramid Lake. Coupled with historical tensions over federal management of Anaho Island as a wildlife refuge separate from, yet in the heart of Pyramid Lake Paiute tribal lands, this question of water rights will ultimately affect the nesting success of one of the largest breeding colonies of the White Pelican in North America.

Protecting seabirds by conserving islands: an integrated regional approach

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Introduced mammals are the primary cause of recent seabird extinctions and current seabird endangerment. This is because mammalian predators have been introduced to most of the world's islands, where breeding seabirds evolved in the absence of terrestrial predators, and therefore lack appropriate life history, morphological, and behavioral defenses. Removing introduced mammals from islands can protect seabirds, and we believe this can be done effectively by regional island conservation organizations that integrate: (1) applied research and priority setting; (2) public education and policy work; (3) capacity building; and, (4) conservation action. In Northwest Mexico, we developed such an organization, and together with our partners at the Universidad Nacional Autónoma de México, Centro de Investigaciones Biológicas del Noroeste, and the Mexican National Protected Areas Department we have removed 29 populations

of introduced mammals from 23 islands. These removals protected 69% of the region's seabird species and subspecies and 67% of the region's endemic seabirds.

Survival of Rhinoceros Auklets in central California

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Understanding survival patterns is key to population dynamics of long-lived seabirds. Contrary to trends in most other central California seabird populations, Rhinoceros Auklet (*Cerorhinca monocerata*) populations seem to have increased, and some data show that Rhinoceros Auklets may not be as severely affected by El Niño events as other seabirds in the California Current. However, California Rhinoceros Auklet populations are still relatively small, and they are especially vulnerable to oiling events and other pollution, human disturbance, and climate change resulting in changes to their prey base. Rhinoceros Auklets lay only one egg per year, resulting in slow population growth even under favorable ecological conditions. Survival has been documented in some other long-lived seabird species as differing between populations, sometimes dramatically. Only one previous estimate of adult survival exists for Rhinoceros Auklets, and not many survival estimates of California alcid populations are available. We estimated survival of adult Rhinoceros Auklets breeding on two of the three main breeding colonies in California, Año Nuevo Island and Southeast Farallon Island, over the past 9 years and 14 years, respectively. We simultaneously analyzed mark/recapture data, band-recovery data from dead animals and live-resighting data between capture intervals, examining influences of colony, year, environmental variables, breeding and resighting probabilities, reproductive success, experience, and sex. We compared our estimates to that of a British

Columbia population (Triangle Island), as well as to several estimates available on puffins, which are close relatives of Rhinoceros Auklets, and other alcids.

A plumage character for distinguishing second-year from older Marbled Murrelets during the breeding season

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Knowledge of age of first breeding is critical to understanding demography of any species. Unfortunately, external plumage and soft part characters of most alcids do not differ between sexes or among age cohorts by spring of their second calendar year, i.e., after completion of first prebasic or first prealternate molt. As a result, determining age at first breeding requires capturing and marking young birds, and subsequently recapturing them when they return to breed. Because Marbled Murrelets (*Brachyramphus marmoratus*) are difficult to capture, few such data for this species exist; this has hampered our ability to determine age at first breeding in murrelets. In the course of a separate study, we serendipitously discovered that underwing covert color can be used reliably to distinguish second-year from older murrelets. Museum skins of murrelets collected in January through June that had fleshy or thin-walled bursae were assumed to be second-year birds and, therefore, in first alternate plumage. These birds had whitish underwing coverts in most cases (81.5%). In contrast, murrelets in breeding condition and/or that lacked fleshy or thin-walled bursae were assumed to be older adults. Most of these birds (85.5%) had grayish-brown underwing coverts. In addition, we speculate that the 14.5% of birds that lacked bursae and/or that

were in breeding condition, but that also had whitish underwing coverts probably were second-year birds attempting to breed for the first time. Thus, in spring and summer (prior to onset of definitive prebasic molt, typically in July-August), whitish underwing coverts indicate that a murrelet is a second-year bird with >80% accuracy, and probably with >95% accuracy.

Evidence for renesting in Marbled Murrelets—take II

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Renesting in Marbled Murrelets (*Brachyramphus marmoratus*) has been suggested at previous PSG meetings, and this year the evidence for renesting has grown. We report evidence for renesting in Desolation Sound, BC, for 1999–2001, coming from four independent sources: (1) physiological analyses of egg-precursor protein (vitellogenin); (2) brood patch scores; (3) radiotelemetry; and (4) confirmed renesting of one Marbled Murrelet. Breeding status is assessed in individuals that are tracked using radiotelemetry throughout their breeding cycle, and compared to breeding status inferred at the time of capture. Evidence is as follows: (1) The presence of egg-producers for so long in the study area suggests there is sufficient time in the season to renest, if birds start early enough. (2) Egg-producing and fully-developed brood patches occurred, in some cases, much earlier in respect to the date that incubation actually began; this suggested that delay or re-nesting had occurred in the interim. (3) Radiotelemetry data tracked nest attendance patterns that were not consistent with one full incubation term, but suggestive of a failed incubation term followed by a successful one. (4) One individual was found incubating at a nest 30 days after laying an egg in the hand of a researcher. It may be that Marbled Murrelets can

recover from disruption of a breeding attempt (especially egg loss), if they initiate breeding early enough in the season. These results have strong implications for Marbled Murrelet demography and annual fecundity estimates.

Use of aerial surveys in oil spill response

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During the past decade, aerial surveys of marine birds and mammals have become a significant component of oil spill response strategy, providing near real-time data on the abundance and distribution of vulnerable species at sea. Aerial observers can quickly locate areas of high potential impact and provide information necessary to direct response efforts. In California, rapid response at sea surveys are conducted by the University of California Santa Cruz (UCSC) aerial survey team under contract with the California Department of Fish and Game, Office of Spill Prevention and Response. Since its inception in 1994, the UCSC survey team has responded to six oil spills, and participated in five oil spill response drills. The UCSC survey team also conducts bimonthly training surveys in state waters. Survey coverage has been heaviest in the Monterey Bay area and, in the past year, off the Big Sur coast. We have flown more than 80 surveys, covering thousands of nautical miles, and recorded tens of thousands of sightings. These distribution and abundance records comprise a significant data set that provides historical perspective and can be used for management and spill response decisions. In some instances, the appropriate use of distributional data has the potential

to significantly reduce spill-related seabird mortality.

Population monitoring of breeding American White Pelicans (*Pelecanus erythrorhynchos*) at Stum Lake, British Columbia

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Stum Lake, found within White Pelican Provincial Park, contains the only nesting colony of American White Pelicans (*Pelecanus erythrorhynchos*) in British Columbia. The lake is located approximately 70 kilometers west of Williams Lake, BC, and includes four islands on which breeding pelicans nest. American White Pelicans are legally designated as Endangered under the BC Wildlife Act and are included on the provincial Red List. The population of nesting pelicans at Stum Lake has been monitored periodically from 1953 to 1976 and annually from 1977 to 2001 to provide trend data on the number of nesting pairs in the population. The minimum numbers of adult pelicans and young of the year were counted by observers using binoculars and telescopes. Counts of nest depressions were obtained by walking on the breeding islands late in the breeding season after chicks had fledged. From 1968 to 1987, the number of nests fluctuated but stayed within the range of 85 to 125 nests. After 1987, however, the number of nests increased from 110 in 1987 to a maximum of 423 nests in 1993. Since 1993, the number of nests has declined slightly and varied from a high of 365 to a low of 213 nests. The number of young of the year exhibits a wider degree of fluctuation than the number of nests, to the extent that three breeding failures (15 surviving young) have been observed since 1972. Despite these periodic breeding failures, there has been an overall trend of increasing

number of young from an average of 66 in the 1970s to an average of 175 in the 1990s.

Seabird ecology, El Niño anomalies, and prediction of sardine fisheries in the Gulf of California

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Small pelagic fish constitute 25 to 40% of the fisheries landings in Mexico. Over 70% of these landings, predominantly Pacific sardine (*Sardinops caeruleus*), are captured in the Gulf of California. Small pelagic fishes are a key component of the Gulf's ecosystem; they are eaten by seabirds, sea mammals and other fishes. Accurate prediction of total landings and catch per unit effort (CPUE) is essential for the sustainable management of the sardine fishery in the Gulf, where it has been showing signs of overfishing since the early 1990s. We developed two statistical models that use oceanographic conditions and seabird breeding and feeding data to predict total catch and CPUE of Pacific sardine in the central Gulf. Total catch was predicted with an accuracy of 74% by a linear model incorporating the Southern Oscillation Index (SOI), the clutch size of Heermann's Gulls (*Larus heermanni*), and the proportion of sardines in the diet of Elegant Terns (*Sterna elegans*). CPUE was predicted with an accuracy of 80% by a model based on the proportion of sardines in the diet of Elegant Terns, the reproductive success of Heermann's Gulls, and the spring-

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time sea surface temperature anomaly in the Gulf region. Our results show that the reproductive ecology of seabirds is coupled to the global and local oceanographic conditions, and that this information can be used to anticipate the outcome of fishing efforts.

Molting and breeding frequency in the Black-footed Albatross: do current investments limit future reproduction?

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Life history theory suggests a trade-off between current reproductive effort and future reproductive output. In birds, current reproductive investment can limit the number of feathers molted, which can negatively affect survival and future reproductive success. Large birds do not have enough time to breed and replace all flight feathers within an annual cycle. Black-footed Albatross (*Phoebastria nigripes*) exhibit a pattern of incomplete primary molt and occasionally skip a breeding season. I scored primary molt and reproductive success of *P. nigripes* on Tern Island, French Frigate Shoals, to investigate the trade-off between time allocated towards breeding and molting. The number of primaries replaced varied with age and time invested in reproduction. Even aged birds replaced $\bar{x} = 4.93$ primary feathers while birds of odd ages replaced $\bar{x} = 8.62$. Birds with a high reproductive investment replaced $\bar{x} = 0.84$ fewer feathers than those whose nests failed early. The number of worn feathers was not correlated with the probability of returning to breed the following season, but the time invested in current reproduction and feather condition were. Albatrosses with worn feathers or high reproductive investment were less likely to return to breed than were birds with fresh feathers or low reproductive investment. Additionally, birds that returned to breed with very worn feathers had lower re-

productive success than birds with less feather wear. This research suggests, within a pair, the condition of the female's primary feathers is more important than the male's in explaining the probability of returning to breed.

Population biology and trends of the Black-footed Albatross at Tern Island, French Frigate Shoals

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Declines in the number of breeding Black-footed Albatross pairs have been recorded at three permanently manned U.S. Fish and Wildlife Service field stations in the Hawaiian Islands. Studies describing the demography and population biology of this species are needed to accurately assess these trends. Analyzing a six-year mark-recapture data set from Tern Island, French Frigate Shoals, I determined age-specific survival, juvenile survival (survival to recruitment), age at first reproduction, and rate of recruitment. I also monitored reproductive success for two years to determine age-specific reproductive success. Using these parameters, I determined the annual growth rate for the population. Survival for birds 5 years and older was 0.89 (CI = 0.87 to 0.91), and annual survival from fledging to 5 years old was 0.79 (CI = 0.76 to 0.82). Hatching success did not vary between years, but fledging success did. Birds ages 6–9 had lower hatching and fledging success than birds that were 10 years and older. The minimum recorded age at first breeding was 5 years old. Ninety-nine percent of the breeding population was recruited into the breeding population by 9 years of age with the mean age at first reproduction at 7 years old. The annual growth rate of the population was calculated as 0.9612. Elasticity analysis indicated that population trends are more sensitive to changes in survival than in fecundity. Additionally, adult survival

contributed more to the annual growth rate than juvenile survival.

Oceanic habitat of tropical seabirds: exploring habitat relationships with generalized additive models

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We applied generalized additive models in order to investigate habitat relationships of pelagic seabirds in the eastern tropical Pacific. Six seabird distribution and abundance were recorded from two National Oceanographic and Atmospheric Administration (NOAA) research vessels using 300-m strip transect methods during 386 days at sea, in the boreal summer and fall of 1989 and 1990. Habitat was quantified using the following oceanographic variables, recorded from the same vessels: sea surface temperature, salinity, water density, and chlorophyll, thermocline depth and strength. We chose six seabird species representing a diverse group, with respect to phylogeny and ecology (i.e., diet and foraging methods). Seabirds chosen were Juan Fernandez Petrel (*Pterodroma externa*), Wedge-tailed Shearwater (*Puffinus pacificus*), Leach's Storm Petrel (*Oceanodroma leucorhoa*), Wedge-rumped Storm Petrel (*O. tethys*), Red-footed Booby (*Sula sula*), and Red-tailed Tropicbird (*Phaethon rubricauda*). Habitat models were fitted using a forwards and backwards stepwise selection process, based on the Akaike Information Criterion.

We used data from 1989 to produce models for each species, then applied each model to real oceanographic data from 1990, in order to predict abundance and distribution patterns for the corresponding species for 1990. Predicted patterns were compared to those observed in order to

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assess the validity of each model, by calculating residuals representing the difference between predicted and observed densities. Effect of seabird relative abundance and sample size on the model outcome was evaluated with a non-parametric bootstrap.

Developed models were able to depict real patterns of distribution and abundance of the studied seabirds, but were limited by sample size of rare and less abundant birds. Factors discerning habitat for each seabird varied from phylogeny to ecology to both, with seabird foraging ecology being the most influential. Generalized additive models proved to be a valuable tool in identifying habitat relationships for pelagic seabirds.

The importance of local prey abundance in determining the strength of spatial associations between non-breeding seabirds and prey in near-shore Monterey Bay

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Food availability is often considered a primary factor shaping the at-sea distribution of marine predators. One approach to understanding the nature of this effect has been to examine spatial relationships between predators and their prey. Spatial correlations between breeding seabirds and their prey are often strongest at large (>3km) spatial scales. Fine-scale associations are considered limited by perceptual constraints or time constraints, such as those imposed by central-place foraging. In this study, I hypothesized that, because nonbreeding seabirds are no longer central-place foragers, spatial correlations between seabirds and prey would be stronger in nonbreeding birds than those reported for breeding birds. I also expected that seabirds would be more closely linked with acoustic biomass when prey availability is low. During winters 1998–2000, I measured acoustic biomass and the distribution of four piscivorous seabirds (Brandt's Cormorants [*Phalacrocorax penicilla-*

tus], Common Murres [*Uria aalge*], Pacific Loons [*Gavia pacifica*], and Rhinoceros Auklets [*Cerorhinca monocerata*]) in nearshore Monterey Bay. I found that, overall, there was no significant correlation between three seabird species and acoustic biomass on spatial scales up to 13 km. However, on days when acoustic biomass was below the median for the study period, cormorants, murres, and loons were strongly associated with biomass at scales ranging from 0.2 to 3.2 km. Birds were correlated with acoustic biomass at larger spatial scales when acoustic biomass was very low. This study suggests that seabirds track prey at smaller spatial scales during the nonbreeding season than during the breeding season, but only when local food supplies are in high demand.

Long-term changes in the type, but not amount, of ingested plastic particles in Short-tailed Shearwaters in the southeastern Bering Sea

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Plastics are major pollutants in the marine environment, and their ingestion by seabirds has become a global conservation concern. However, few studies have been published that describe temporal trends in plastic ingestion by seabirds since 1988, when Annex V was adopted for the International Convention for the Prevention of Pollution from Ships (MARPOL), prohibiting the disposal of plastic material at sea. In this study, we report the current (1997–99, 2001) incidence, amount, and predominant type of ingested plastic found in Short-tailed Shearwaters (*Puffinus tenuirostris*) in the southeastern Bering Sea. We compare our results with plastic reported in shearwaters from the same region during 1970–78. Because the basis for concern about plastic is that it is harmful to seabird health, we also examine the relationship between ingested plastic

and shearwater body mass. We found that 84% of shearwaters sampled contained plastic ($n = 330$). The incidence and amount of ingested plastic have not shown significant change since the 1970s; however, the predominant type of ingested plastic in shearwaters has changed from industrial plastic to user plastic. We suggest that the availability of neuston plastic to seabirds in the Bering Sea has undergone a shift in composition since the 1970s. We found no significant correlation between the amount, number, and total volume of plastic particles and shearwater body mass. Shearwater body condition appears little if at all impaired by plastic, at least at present levels of consumption.

Regulation of wing-beat behavior against buoyancy change in deep-diving Thick-billed Murres

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Breath-holding divers are expected to conserve oxygen consumption while they are making dives longer than the theoretical time during which they consume their whole oxygen store. Contrary to marine mammals, seabirds hold much air in their respiratory system and feathers, and hence they have high buoyancy in shallow water. A recently developed mechanical model for Thick-billed Murres (*Uria lomvia*) predicts that the birds maintain a swimming speed which minimizes their drag coefficient (Lovvorn, J Exp Biol 202:1741, 1999). To do so, they have to regulate their thrust power against rapidly changing buoyancy, presumably through regulation of wing-beat

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frequency or power. We measured wing-beat behavior in diving Thick-billed Murres in the wild based on the 1/32 Hz sampling of accelerations along head-tail axis and ventral-dorsal axis by small bird-borne data loggers. The murres slightly decreased their beat frequency against the rapid decrease of buoyancy, but they slightly increased their swim speed while they were descending to 100 m depth. While they were ascending, they decreased wing beat frequency to the depth of neutral buoyancy (ca. 60 m), and then they stopped beating their wings after that. As a result they could maintain a speed minimizing drag coefficient until ca. 20 m depth, then they accelerated while they were freely ascending with increasing buoyancy in shallower water.

At-sea density monitoring of Xantus's Murrelets at Anacapa and Santa Barbara Islands, California, in 2001

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In 2001, we used nocturnal spotlight surveys to assess changes in numbers of Xantus's Murrelets (*Synthliboramphus hypoleucus*) in nocturnal at-sea congregations beside breeding colonies, as part of a monitoring program to measure expected murrelet population increase at Anacapa Island (ANA) after the eradication of rats (*Rattus rattus*). Similar surveys also were conducted at Santa Barbara Island (SBI) for comparison. Nocturnal spotlight surveys involved scanning waters within 75 m of an inflatable boat traveling at slow speeds along GPS transects and recording the number of murrelets per observation, distance from the observer, angle from the transect line, and GPS location. We

sampled one main area at each island using standardized transects about 1.9 km long at distances from shore of 200 m (inshore) and 500 m (offshore). Murrelet densities were estimated using three methods: (1) 150-m strip transects; (2) a line transect detection function fitted to pooled distance data; and (3) the most frequently identified detection function fitted to individual surveys. Density differed among the three methods, with line transect detection function and strip transects yielding consistently higher and lower densities, respectively. Density estimates varied widely for all three methods at both islands (e.g., the range of strip transect densities was 19–472 murrelets/km² at ANA and 41–522 murrelets/km² at SBI). Densities were higher on the inshore than offshore transects at both islands. Densities were not statistically significant between different times of night (2200, 0100, and 0400), and we detected no consistent trends in attendance patterns through the night. Densities decreased through the season (mid-April to late May) at ANA.

Chronic oil pollution in Newfoundland and its impacts on Thick-billed Murre (*Uria lomvia*) populations in the Canadian Arctic

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Seabirds have been used as monitors of marine oil pollution for decades. Seabirds are mostly affected by large catastrophic oil spills and by the continuous illegal discharges of oily bilges from large trans-Atlantic vessels. This type of chronic oil pollution has been an ongoing global problem since the early part of the 20th century wherever large seabird concentrations and shipping lanes overlap. Chronic oil pollution is thought to be more detrimental to seabirds than catastrophic spills, but its impacts on populations have been difficult to assess. In Newfoundland,

Canada, chronic oil pollution has been documented using systematic beached bird surveys since 1984. Over the last three years, a detailed large-scale study determined the total number of seabirds that die due to oil in Atlantic Canada and assessed whether some species show population impacts due to this anthropogenic disturbance. Methods included weekly beached bird surveys, persistence and deposition studies of oiled and unoled beached corpses, buoyancy studies, large-scale drift block experiments, and population modeling. An average of 300,000 seabirds is estimated to die annually due to illegal discharges of oil in Atlantic Canada. Thick-billed Murres (*Uria lomvia*) are the species most affected. A demographic and environmentally stochastic population model for Thick-billed Murres revealed that the cumulative effects of the traditional Newfoundland winter murre harvest and chronic oil pollution decrease population growth by 40% per annum. Current levels of marine oil pollution and murre population impacts are important conservation issues and are of immediate concern beyond our region.

California Brown Pelicans nesting in the Pacific Northwest?: potential for a major northward expansion in breeding range

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Several observations suggest that California Brown Pelicans (*Pelecanus occidentalis californicus*) may be on the verge of nesting in the Columbia River estuary, over 1200 km north of their current northernmost colony. These observations include (1) progressively earlier spring arrival on East Sand Island, (2) large numbers present on the island from early June to late November, (3) association with a large breeding colony of Double-crested Cormorants (*Phalacrocorax auritus*),

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(4) local abundance of anchovy (*Engraulis mordax*) and sardine (*Sardinops sagax*) prey, and (5) frequent courtship displays and other breeding behavior. Brown Pelicans first arrived in the estuary in 2001 on April 9 and were abundant throughout the summer and fall. The presence of the large Double-crested Cormorant colony on East Sand Island apparently acts as a social attractant for Brown Pelicans, may aid pelicans in predator detection and food finding, and may stimulate breeding behavior in pelicans. Anchovy and sardine were particularly abundant in the diet of other piscivorous seabirds in mixed foraging flocks with Brown Pelicans near East Sand Island. We observed adult pelicans bowing, head swaying, exchanging nesting materials, building nests, mounting, and copulating. Establishment of a breeding colony of Brown Pelicans on East Sand Island may be precluded, however, by several types of disturbance that we documented, including seabird researchers, boaters, fishers, and Bald Eagles (*Haliaeetus leucocephalus*).

Local at-sea distribution of breeding and non-breeding radio-marked Marbled Murrelets during the summer

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Current efforts to conserve Marbled Murrelets (*Brachyramphus marmoratus*) focus on terrestrial habitat; here, we present evidence that there may be equally sensitive marine foraging areas that are of high value to breeding individuals. We combine daily individual radiotelemetry tracking from helicopters throughout the breeding season with breeding status in kernel home-range analysis to disseminate the potential differences between core areas of marine habitat use by breeding and non-breeding individuals at sea. Breeding birds are detected us-

ing behavioral "on/off" patterns of incubation at the nest from radio telemetry data, whereas non-breeders do not show this pattern and are found only on the water. Based on our multi-year study in Desolation Sound, British Columbia, we suggest that breeding murrelets may be concentrated annually in specific marine regions within our study area, where prey may be more abundant than in surrounding area, rather than using all marine areas equally. If this is a general phenomenon, the proximity of particular terrestrial and marine attributes should be considered when making conservation plans for this species.

Having your eggs and eating them, too: a simulation model for exploring the effects of predation and egg harvest at a gull colony

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I developed an individual-based simulation model to explore the effects of harvesting eggs from a seabird colony that also experiences egg loss from avian predators. The model has direct application to Glacier Bay National Park, where resource managers are concerned about potential effects of traditional Native Alaskan egg harvesting practices at colonies within the park. Model parameters were derived from monitored Glaucous-winged Gull (*Larus glaucescens*) nests. The model simulates the sequence of egg laying, relaying, and incubation to hatching for individual nests and returns hatching success, incubation length, total egg harvest, total eggs laid, and harvester and predator search efficiency for all nests in the simulation. Stochasticity is incorporated in the distribution of nest lay dates and predation and harvest events. The model assumes that (1) all nests are equally vulnerable to predation, (2) predation rates are constant throughout the season, (3) the relaying response is the same whether eggs are lost to harvesters or predators, and (4)

gulls will not re-lay if they have already laid a total of 8 eggs or have laid and lost 2 full clutches. Model outputs suggest that (1) even very low predation rates have a greater impact than egg harvesting because the former occurs throughout the season, (2) varying the number of days a set harvest level is conducted has little impact, and (3) restricting harvest to one day early in the nesting season provides the greatest total harvest with the least effect on gull hatching success over varying background predation rates.

Status of the Red-legged Cormorant in Peru: what factors affect distribution and population size?

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The distribution and abundance of Red-legged Cormorants (*Phalacrocorax gaimardi*) were assessed by visiting 42 localities on the mainland and surveying most of the islands along Peru's 2500 coastline [*sic*] between October 1999 and December 2000. Cormorants were distributed in small discrete groups (mode = 5 birds, range = 1–69) from Isla Foca (5° 12' S) to Morro Sama (18° 0' S). The southern coast (56% of the total population) and central coast (34%) held a larger proportion of cormorants than did the northern region (10%). The population was mainly located in non-legally protected areas, either on islands (6%) or on the mainland (51%). We counted 658 birds (95% adults, 5% juveniles), but based on bird density, availability of suitable habitats, and cliff lengths, we predicted a total population size in Peru of 1,802 ± 282 birds. Red-legged Cormorants have undergone a spectacular decline over the last 30 years. Between 1968 and 1999–2000, the population at ten localities in the north-

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ern and central coast decreased from 3229 to 69 birds. It is likely that low numbers reflect the devastating effects of the strong ENSO of 1997–98 as numbers prior to and after this event at eight southern localities decreased by

73%. Because of the inaccessibility of their nesting and roosting sites and the lack of natural predators, Red-legged Cormorants are apparently not in danger on land. However, entanglement in fishing nets, competition for food in

inshore waters, pollution, human disturbance, and harvesting of kelp banks are potential threats at sea and could affect the population's recovery.

BOOK REVIEW

A Field Guide to the Birds of Korea. By Woo-Shin Lee, Tae-Hoe Koo and Jin-Young Park. Illustrated by Takashi Taniguchi. Translated by Desmond Allen. 2000. LG Evergreen Foundation, Seoul, Korea. 328 pp. 120 color plates. Paperback. ISBN: 89-951415-0-6. \$35.00.

Reviewed by Malcolm Coulter

This is the latest in a number of bird field guides for Asia and sponsored in part by the Wild Bird Society of Japan. The others are field guides to the birds of Japan (Japanese and English), water birds of Asia (English), and birds of Taiwan (Chinese). All are excellent and follow similar formats. Illustrations are on right-hand pages, and facing them are brief species descriptions and range maps. The Korean guide was written and is available in Korean; the English translation is described here. This is the only guide for the Korean peninsula in English. It is small enough to be used easily in the field. This is a very good guide.

The illustrations by Takashi Taniguchi are excellent and are the strong point of the guide. He also illustrated the Taiwan field guide and the guide to the waterbirds of Asia. Some illustrations

are new, some are the same as those in the other guides, and some are the same but modified slightly. They should be adequate by themselves for identification in most cases.

The descriptions are brief and insufficient for identification. They should be consulted in conjunction with the illustrations. The text includes the name (English, Latin, and Korean in Latin letters); status in Korea; description; similar species when appropriate; habitat in Korea; and (for some species) "status." The last is usually a list of places where the species is regularly recorded.

The range maps are small. They cover northeast Asia in all cases, and also Southeast Asia in some cases. Summering and wintering ranges are presented, but migration routes are not included. Hence, the maps present only a general idea of the distribution in eastern Asia and are not helpful in indicating where the birds are found in Korea. In some cases, the maps contain incorrect information for Korea. For instance, the Saunders Gull, (*Larus saundersi*), which I believe breeds at least in northern South Korea, is shown only as a winter resident.

If one were looking for a specific bird in Korea, the maps will be of little help. This is disappointing. In part, this

may be understandable in the difference in availability of information in North and South Korea. While there are probably good records of the distribution of birds in South Korea, their distribution in North Korea is probably less available.

Similar range maps are presented in the guides to the birds of Japan and Taiwan. But the maps for any species differ slightly among the guides. The maps should be taken as a general indication of the range of the species but the details should not be taken definitively.

The *Field Guide to the Birds of Korea* is small, sturdy and well produced. Unlike some modern guides that are large and inconvenient into take to the field, this is small enough to be easily used in the field.

This guide, as well as the others mentioned above, will help in the development of ornithology in these countries, in part because they are available in the local languages. This is important. Furthermore, they will promote conservation and bird watching. For those of us who speak only English, we will benefit from the English translations when we visit these countries.

CORRECTIONS

Below are corrections of errors that appeared in a previous issue. The editor apologizes to the affected authors. Please let me know if you find a mistake in a *Pacific Seabirds*.

In the Regional Report for Washington for 2001, Pacific Seabirds 28(2):86, some sections were inadvertently transposed. Affected paragraphs are printed correctly below, from the start of the section through the first paragraph of Julia Parrish's contribution.

WASHINGTON—SEABIRDS OTHER THAN MARBLED MURRELETS

Lora Leschner is working on a report for the US Fish and Wildlife Service (USFWS) on "Seabird Research in Washington, 1980 to 2001," to be included in the Pacific Region Seabird Conservation Plan. She will be contacting seabird researchers about their current work and their publications. Lora is also working on a pilot project to use volunteer ornithologists to monitor shorebirds in the estuaries of northern Puget Sound. This project is part of the National Shorebird Monitoring Plan. In addition to monitoring, she will work with volunteers to get elementary school kids involved in the Shorebird Sister Schools program.

The Washington Department of Fish and Wildlife (WDFW), which owns most of the Skagit estuary shoreline and land in Padilla Bay, is working with Ducks Unlimited on habitat management projects that benefit both waterfowl and shorebirds.

David Nysewander, Joe Evenson, Bryan Murphie, and Tom Cyra are continuing several monitoring studies associated with the marine bird component of the Puget Sound Ambient Monitoring Program (PSAMP). PSAMP is a state and federal interagency effort in Washington State, which monitors various components of the inner marine waters that extend east from the mouth of the Strait of Juan de Fuca, north into the

San Juan Islands and Georgia Basin, and southwards into Puget Sound proper.

Winter aerial surveys of marine birds and waterfowl were conducted again in December 2000 and January 2001. Data and map products are available in ARC GIS format for the 1992-2001 winter and 1992-1999 summer surveys. These are available from the Wildlife Resources Data Section of WDFW in Olympia through Shelly Snyder at 360-902-2483. Restricted funding prevents continuation of the summer aerial surveys, but the 2001-2002 winter aerial surveys will be continued, in part due to continuing concern about the decline of many marine bird species in this region (13 of 18 examined) over the last 20 years. The largest declines are associated either with fish-eating species like Western Grebes that prey upon forage fish, or with species like scaup and scoters that feed on eggs of forage fish. Forage-fish eggs may be required for acquisition of sufficient fat reserves for migration and initiation of reproduction, and availability of this food is declining.

The PSAMP program, USFWS, and volunteer groups have also just completed the third year of boat-based censuses of Pigeon Guillemots at breeding sites. The surveys are made during May of each year. The effort this year extended the standardized protocol and timing of surveys to all sites that were checked last year, plus a few that were missed in 1999. The surveys provides a more standardized methodology for monitoring selected breeding species found throughout all of the greater Puget Sound and will entail at least a five-year collaboration. Contact Joe Evenson at 360-902-2524 for further information on this effort.

The PSAMP team also conducted aerial surveys during June 2001 focusing on Great Blue Herons. This was part of a

pilot project coordinated by Don Norman, in collaboration with ground-based volunteer observers, to evaluate the feasibility of monitoring great blue heron numbers from aerial surveys on their marine feeding areas in northern Puget Sound. Contact Don at 206-542-1275 for further information and results associated with this effort.

Julia Parrish (University of Washington [UW]), assisted by her graduate students and research technicians, monitored three Common Murre colonies on the coast of Washington and Oregon in 2001: Tatoosh Island, Yaquina Head, and a new site, Point Grenville in Copalis National Wildlife Refuge. An eleventh year of data was added to the long-term monitoring study of breeding, predator-prey interaction and provisioning at the Tatoosh Island colony. Thanks to a scarcity of Bald Eagles and an abundance of forage fish, murre attendance and reproductive success reached all-time highs. All surface nesters on the island did well, including Glaucous-winged Gulls, Pelagic Cormorants, and Double-crested Cormorants. Tom Good, although busy with his new appointment on the salmon recovery team at NMFS, managed to find time to pursue his study of factors affected gull breeding success at Tatoosh Island. Nathalie Hamel completed her last year of data collection for her master's degree at UW. She headed the radio-tracking project and collected information on the foraging distribution and post-breeding migration of Tatoosh Island murrelets. Once again, the murrelets are heading into the Strait of Juan de Fuca and Puget Sound. Thanks to everyone in the Tatoosh field crew, including Colin French, John Huckabee, Kip Parker, Erin Hagen, Emily Meredith, Jen Convy, and Kate Little for their invaluable assistance....

[Continued in PS 28(2)]

PUBLISHED PROCEEDINGS OF SYMPOSIA OF THE PACIFIC SEABIRD GROUP

The Pacific Seabird Group holds occasional symposia at its annual meetings. Published symposia are listed below. They are available for purchase (unless out of print). To order, see the membership application/publication order form.

SHOREBIRDS IN MARINE ENVIRONMENTS. Frank A. Pitelka (Editor). Proceedings of an International Symposium of the Pacific Seabird Group. Asilomar, California, January 1977. Published June 1979 in *Studies in Avian Biology*, Number 2. Out of print.

TROPICAL SEABIRD BIOLOGY. Ralph W. Schreiber (Editor). Proceedings of an International Symposium of the Pacific Seabird Group, Honolulu, Hawaii, December 1982. Published February 1984 in *Studies in Avian Biology*, Number 8. Out of print.

MARINE BIRDS: THEIR FEEDING ECOLOGY AND COMMERCIAL FISHERIES RELATIONSHIPS. David N. Nettleship, Gerald A. Sanger, and Paul F. Springer (Editors). Proceedings of an International Symposium of the Pacific Seabird Group, Seattle, Washington, January 1982. Published 1984 as Canadian Wildlife Service, Special Publication. Out of print.

THE USE OF NATURAL VS. MAN-MODIFIED WETLANDS BY SHOREBIRDS AND WATERBIRDS. R. Michael Erwin, Malcolm C. Coulter, and Howard L. Cogswell (Editors). Proceedings of an International Symposium at the first joint meeting of the Colonial Waterbird Society and the Pacific Seabird Group, San Francisco, California, December 1985. *Colonial Waterbirds* 9(2), 1986. \$12.00 from Ornithological Societies of North America, PO Box 1897, Lawrence, Kansas 66044; phone (800) 627-0629.

ECOLOGY AND BEHAVIOR OF GULLS. Judith L. Hand, William E. Southern, and Kees Vermeer (Editors). Proceedings of an International Symposium of the Colonial Waterbird Society and the Pacific Seabird Group, San Francisco, California, December 1985. Published June 1987 in *Studies in Avian Biology*, Number 10. \$18.50.

AUKS AT SEA. Spencer G. Sealy (Editor). Proceedings of an International Symposium of the Pacific Seabird Group, Pacific Grove, California, December 1987. Published December 1990 in *Studies in Avian Biology*, Number 14. \$16.00.

STATUS AND CONSERVATION OF THE MARBLED MURRELET IN NORTH AMERICA. Harry C. Carter, and Michael L. Morrison (Editors). Proceedings of a Symposium of the Pacific Seabird Group, Pacific Grove, California, December 1987. Published October 1992 in *Proceedings of the Western Foundation of Vertebrate Zoology*, Volume 5, Number 1. \$20.00.

THE STATUS, ECOLOGY, AND CONSERVATION OF MARINE BIRDS OF THE NORTH PACIFIC. Kees Vermeer, Kenneth T. Briggs, Ken H. Morgan, and Douglas Siegel-Causey (editors). Proceedings of a Symposium of the Pacific Seabird Group, Canadian Wildlife Service, and the British Columbia Ministry of Environment, Lands and Parks, Victoria, British Columbia, February 1990. Published 1993 as a Canadian Wildlife Service Special Publication, Catalog Number CW66-124-1993E. *Free of charge from:* Publications Division, Canadian Wildlife Service, Ottawa, Ontario, K1A 0H3, Canada.

BIOLOGY OF MARBLED MURRELETS—INLAND AND AT SEA. S. Kim Nelson and Spencer G. Sealy (Editors). Proceedings of a Symposium of the Pacific Seabird Group, Seattle, Washington, February 1993. Published 1995 in *Northwestern Naturalist*, Volume 76, Number 1. \$12.00.

BEHAVIOUR AND ECOLOGY OF THE SEA DUCKS. Ian Goudie, Margaret R. Peterseen and Gregory J. Robertson (editors). Proceedings of the Pacific Seabird Group Symposium, Victoria, British Columbia, 8-12 November 1995. A special publication compiled by the Canadian Wildlife Service for the Pacific Seabird Group. Published 1999 as Canadian Wildlife Service Occasional Paper number 100, catalog number CW69-1/100E. *Free of charge from:* Publications Division, Canadian Wildlife Service, Ottawa, Ontario, K1A 0H3, Canada.

SEABIRD BYCATCH: TRENDS, ROADBLOCKS AND SOLUTIONS. Edward F. Melvin and Julia K. Parrish (editors). Proceedings of an International Symposium of the Pacific Seabird Group, Blaine, Washington, 26-27 February 1999. Published 2001 by University of Alaska Sea Grant, Fairbanks, Alaska. Publication no. AK-SG-01-01. \$20.00 from the publisher.

BIOLOGY, STATUS, AND CONSERVATION OF JAPANESE SEABIRDS. Nariko Oka (editor). Proceedings of an International Symposium of the Japanese Seabird Group and Pacific Seabird Group, Lihue, Hawaii, February 2001. Published 2002 in the *Journal of the Yamashina Institute of Ornithology*, volume 33, number 2. Symposium (5 papers), pages 57-147; other papers pages 148-213. In English with Japanese abstracts. \$75.00.

Information on presenting symposia: Pacific Seabird Group Symposia are initiated by any PSG member with interest in a particular topic. The goal is to present a collection of papers that explore and review this topic, usually at an annual meeting of the Pacific Seabird Group. In some cases the papers are then edited and published as a PSG Symposium. Anyone interested in organizing a symposium must first contact both the Coordinator of the Publications Committee and the Scientific Program Chair for an annual meeting. Guidelines will be provided on obtaining approval and on organizing, presenting, and publishing a PSG Symposium, including the responsibilities involved.

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